

UNIVERSITY OF ALGARVE
FACULTY OF ECONOMICS

**WORK-RELATED ACCIDENTS IN PORTUGAL:
CONTRIBUTIONS TO THE IMPROVEMENT OF
PREVENTION EFFECTIVENESS**

ANTÓNIO JOSÉ ROBALO DOS SANTOS

**PhD thesis in Economic and Management Sciences
Speciality of Management**

Work carried out under the guidance of:

Professor Efigénio da Luz Rebelo - Full Professor of the Faculty of Economics of the
University of Algarve

Professor Júlio da Costa Mendes - Assistant Professor of the Faculty of Economics of
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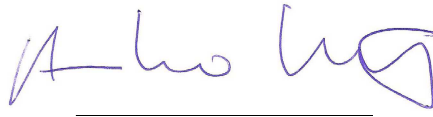
2017

WORK-RELATED ACCIDENTS IN PORTUGAL: CONTRIBUTIONS TO THE IMPROVEMENT OF PREVENTION EFFECTIVENESS

Statement of Work Authorship

I declare to be the author of this work, which is unique and unprecedented. Authors and works consulted are properly cited in the text and are included in the listing of references included.

António José Robalo dos Santos



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Dedication

*To my dearest ones, Nana, Dede, Quico, Sofia and
João, for whom everything is possible;*

*To the Authority for Working Conditions (ACT), for
its irreplaceable role in promoting the improvement
of working conditions in Portugal and in preventing
work-related accidents.*

Acknowledgements

I remember hearing someone say, during the doctoral course, that the doctorate is a very demanding and solitary challenge.

Once here, however, I have found that if, in relation to the level of demand, that prediction was entirely true, the same can not be said of the prediction that this would be a lonely challenge. Indeed, not only did I benefit from the unconditional support of my family and the constant encouragement of my colleagues and friends, but I was fortunate and privileged to count on the unselfish assistance of countless people, without whose support this dissertation certainly would not have seen the light of day.

It is important, therefore, to acknowledge and thank the contribution of all, in the certainty that this dissertation, rather than an individual and solitary work, results from a broad set of contributions from several people.

First of all, I am especially indebted to my supervisors, Professors Efigénio Rebelo and Júlio Mendes, not only for having honored me with the acceptance of my invitation to guide this thesis, but, above all, for the committed and professional way with whom they have done it and for the unconditional support with which they have always distinguished me.

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Moreover, it is important to acknowledge that this research could not be done without the collection and preliminary treatment of the data used. As such, it is also of the most elementary justice to thank to the ACT, in the person of its Inspector-General, Pedro Pimenta Braz, for providing us with the necessary data, mainly the one concerning the work-related accidents inquiries performed by the ACT labour inspectors between 1 January 2013 and 22 October 2015, the Annual Single Report on Occupational Safety and Health (OSH) Service Activities for the year 2014 and the input, output and contextual variables of the ACT activities for the year 2013. My thanks to Pedro Braz

and also to Manuel Roxo, my colleagues at the ACT directorate are also due, for their continuous encouragement and support to this project.

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many hours, days and nights that this work stole me from their company and conviviality, goes my deepest thanks and gratitude.

Any gaps, inaccuracies and errors are, of course, of my full and sole responsibility.

Resumo

O trabalho desempenha um papel fundamental no bem-estar e na qualidade de vida das pessoas e suas famílias. Para além de permitir a obtenção de meios de subsistência, o trabalho promove a auto-estima, a realização pessoal, a dignidade individual, a coesão e estabilidade social, o crescimento económico e a paz (Budd, 2011, 2013; Budd & Spencer, 2015; Danna & Griffin, 1999; Pontifical Council for Justice and Peace, 2004). Para além disso, é hoje amplamente reconhecido que a vida profissional e pessoal das pessoas não são duas entidades separadas, mas sim áreas interligadas e inter-relacionadas (Caudron, 1997; Conrad, 1988; Zedeck & Mosier, 1990).

Paradoxalmente, e em claro contraste com o papel central e com a importância comumente reconhecidos ao trabalho, a Organização Internacional do Trabalho (OIT ou ILO, na sua expressão anglo-saxónica) sustenta que este mata mais gente do que as guerras (ILO, 2005:5).

Com efeito, e de uma força de trabalho global de cerca de 2,84 biliões de pessoas, estima-se que cerca de 2,4 milhões morram anualmente devido a acidentes de trabalho (entre cerca de 350 e 360 mil mortes em cerca de 270 milhões de acidentes de trabalho) e a doenças profissionais (cerca de 2 milhões de mortes) (Hämäläinen, Leena Saarela, & Takala, 2009; J. Takala et al., 2014; Jukka Takala, 2005).

Alli (2008) notou, a este propósito, que na África subsariana morrem anualmente cerca de 54 mil trabalhadores por causas relacionadas com o trabalho e que ocorrem aproximadamente 42 milhões de acidentes de trabalho que provocam pelo menos 3 dias de ausência. Este observou ainda que na América Latina e nas Caraíbas morrem anualmente cerca de 30 mil trabalhadores devido a acidentes de trabalho, ocorrendo anualmente cerca de 22,6 milhões de acidentes de trabalho que provocam pelo menos 3 dias de ausência.

Na União Europeia (UE), por exemplo, de acordo com os últimos dados das Estatísticas Europeias de Acidentes de Trabalho (EEAT) do Eurostat (2016), ocorreram em 2014 cerca de 3,18 milhões de acidentes de trabalho não mortais com 4 ou mais dias de ausência (a que corresponde uma taxa de incidência de 1.536,25) e 3.739 acidentes de trabalho mortais (taxa de incidência de 1,81).

Em Portugal, os números e as taxas de incidência dos acidentes de trabalho mortais e não mortais continuam a ser substancialmente mais elevados do que na maioria dos 28 países da UE (UE 28). Relativamente aos acidentes de trabalho mortais, por exemplo,

Portugal apresentou em 2014 o oitavo maior número de acidentes de trabalho mortais (160) da UE 28 e a quinta maior taxa de incidência de acidentes de trabalho mortais (3,56) da UE 28, a qual corresponde quase ao dobro da taxa de incidência média da UE 28 (cerca de 97% mais elevada). No que concerne aos acidentes de trabalho não mortais, Portugal apresentou em 2014 o quinto maior número de acidentes de trabalho não mortais (130.153) da UE 28 e a segunda maior taxa de incidência de acidentes de trabalho não mortais (2.892,6), a qual é cerca de 88% mais elevada do que a taxa de incidência média da UE 28 (Eurostat, 2016). Acresce que, de acordo com os dados dos acidentes de trabalho mortais ocorridos em Portugal continental que foram objecto de inquérito e de investigação por parte da ACT, 142 pessoas foram vítimas de acidentes de trabalho mortais em 2015; 141 pessoas morreram devido a acidentes de trabalho em 2016; e, apenas entre 1 de janeiro e 1 de março de 2017, 11 pessoas já foram vítimas de acidentes de trabalho mortais (ACT, 2017b). Para além disso, a tendência para a diminuição dos acidentes de trabalho que vinha sendo observada em Portugal nas últimas décadas começou a mostrar sinais muito preocupantes. Em particular, a aparente estagnação, durante 2013 e 2014, da tendência decrescente do número de acidentes de trabalho fatais e o aumento, durante esse período, da taxa de incidência e do número dos acidentes de trabalho não mortais (Eurostat, 2016).

Além das suas consequências devastadoras para as vítimas e suas famílias, particularmente no nível humano e financeiro, os acidentes de trabalho têm também consequências profundamente nefastas para os empregadores e para os Estados, decorrentes dos respectivos custos diretos e indiretos, cujo valor pode ascender a cerca de 4% do seu Produto Nacional Bruto (PNB) (Bird & Germain, 1966, 1986; EU-OSHA, 1998; Fabela & Sousa, 2012; Hämmäläinen et al., 2009; HSE, 2015; Leigh, 2011; J. Takala et al., 2014; Jukka Takala, 2005).

As crescentes preocupações em torno do relativamente elevado número e taxas de incidência dos acidentes de trabalho em Portugal e a emergência da sua luta, conduziu já: à definição da redução do número e das taxas de incidência de acidentes de trabalho em Portugal, como o principal objetivo estratégico da Estratégia Nacional para a Promoção da Segurança e Saúde no Trabalho para os anos de 2015-2020 (Portuguese Government, 2015e); à estipulação de promover a redução dos acidentes de trabalho como o principal objetivo estratégico da ACT, no âmbito da sua Estratégia para os anos de 2013-2015 (ACT, 2014b) e 2017-2020 (ACT, 2017c), assim como nos seus Planos de Atividades para os anos de 2016 (ACT, 2015a) e 2017 (ACT, 2016a); a especificação

pela ACT, no seu Quadro de Avaliação e Responsabilização (QUAR) para os anos de 2016 e 2017, como objectivo principal, promover a redução de acidentes de trabalho, com a fixação de uma meta de 70% para o indicador chave respeitante à percentagem de empregadores a visitar que tenham registado acidentes de trabalho no ano anterior (ACT, 2015b, 2016b). Também incentivou a organização conjunta pela ACT e pela Inspeção do Trabalho e da Segurança Social de Espanha (Inspección de Trabajo y Seguridad Social - ITSS) da campanha Ibérica de Prevenção de Acidentes de Trabalho (ACT & ITSS, 2016) em curso.

É neste contexto, extremamente preocupante e paradoxal, no âmbito do qual o signatário tem desenvolvido a sua atividade profissional como inspetor do trabalho e, mais recentemente, como subinspetor-geral da ACT, que surge esta dissertação de doutoramento, subordinada ao tema ‘Sinistralidade laboral em Portugal: Contributos para a melhoria da eficácia da sua prevenção’ (‘Work-related accidents in Portugal: Contributions to the improvement of prevention effectiveness’).

A relevância do tema escolhido deriva, desde logo, e conforme o próprio nome deixa antever, do facto de a presente investigação visar, no essencial, dar um contributo para a melhoria da eficácia na prevenção dos acidentes de trabalho, de molde a promover uma melhor compatibilização entre, por um lado, o direito e a necessidade de trabalhar e, por outro, o direito e a obrigação de preservar e promover a vida, a saúde, a integridade física e o bem-estar dos trabalhadores.

Dando continuidade ao trabalho pioneiro iniciado pelo Papa Leão XIII no final do século XIX, sobre a condição dos operários, através da sua carta encíclica *Rerum Novarum* (Leo XIII, 1891), e respondendo ao repto lançado pela OIT (ILO, 1999, 2001c, 2004, 2008) e também posteriormente abraçado pela União Europeia (European Commission, 2006a; European Parliament, 2007), de transformar o trabalho digno numa realidade para todos, o presente trabalho procura assim descobrir caminhos susceptíveis de permitirem melhorar a eficácia e a eficiência do combate à pandemia dos acidentes de trabalho em Portugal, com o objectivo último de poder contribuir para a redução das mortes, das lesões e das demais consequências nefastas provocadas pelos acidentes de trabalho.

A relevância e premência deste tema resultam também do facto de que, em Portugal, os números e as taxas de incidência dos acidentes de trabalho mortais e não mortais são substancialmente mais elevados do que os apresentados pela maioria dos parceiros europeus, a que acresce a preocupação decorrente da verificação, a partir de 2013, de uma

ligeira inversão da tendência decrescente que aqueles indicadores vinham apresentando nas últimas décadas.

A importância de que se reveste o tema proposto radica também, como se verá mais adiante, na manifesta escassez de literatura específica sobre este tema, não obstante o reconhecimento, pela Comissão Europeia e pela OIT (European Commission, 2014; ILO, 2017), da relevância de se dispor de dados estatísticos fiáveis e atempados, estudos científicos e instrumentos de monitorização e avaliação na área dos acidentes de trabalho, no sentido de melhorar a qualidade das decisões políticas neste domínio. Este último, aliás, justificou o facto de o tema escolhido pela OIT para a sua campanha anual sobre o Dia Mundial da Segurança e Saúde no Trabalho de 2017 se focar na necessidade crítica de os países melhorarem a sua capacidade para recolher e utilizar dados fiáveis no domínio da segurança e saúde no trabalho (ILO, 2017).

Com efeito, e não obstante os valiosos contributos encontrados no decurso da revisão da literatura levada a cabo no âmbito desta investigação, e tanto quanto é do nosso conhecimento, não existem em Portugal estudos científicos sobre, especificamente, os preditores dos acidentes de trabalho mortais e sobre a eficácia do nosso sistema mandatário de gestão da segurança e saúde no trabalho na prevenção dos acidentes de trabalho. Acresce que, a par da comumente reconhecida lacuna da literatura internacional no campo da eficácia dos Sistemas de Gestão da Segurança e Saúde no Trabalho (OSHMS) na prevenção dos acidentes de trabalho, tendo sobretudo em conta, em especial, o seu pequeno número, limitações metodológicas e resultados mistos e inconclusivos (Frick, Jensen, Quinlan, & Wilthagen, 2000; Gallagher & Underhill, 2012; Robson et al., 2007; Stolk, Staetsky, Hassan, & Kim, 2012), na revisão da literatura realizada no âmbito desta investigação, não foi encontrado nenhum estudo empírico, artigo científico ou relatório sobre a eficácia dos OSHMS na prevenção de acidentes de trabalho (mortais e não mortais) em Portugal, nem foi encontrado qualquer estudo ou publicação sobre a avaliação do desempenho das inspecções do trabalho com vista a avaliar quantitativamente a sua eficiência e a sua eficácia, através da utilização de uma única medida agregada de desempenho e considerando a utilização simultânea de múltiplos indicadores de recursos, resultados e *outcomes* com seleção endógena de pesos.

O tema escolhido é desenvolvido e estruturado em torno de três tópicos principais e interligados, entendidos como caminhos susceptíveis de conduzir à melhoria da eficácia do combate aos acidentes de trabalho em Portugal: a melhoria da eficácia na prevenção da ocorrência de acidentes de trabalho mortais, através da identificação e focalização

dos recursos nos seus preditores; a melhoria da eficácia do sistema mandatório de gestão da segurança e saúde no trabalho na prevenção dos acidentes de trabalho em Portugal, através da identificação e concentração dos recursos nos respectivos factores críticos de sucesso; e a melhoria da eficácia da ACT na prevenção dos acidentes de trabalho em Portugal, através da identificação e focalização dos recursos nos indutores da sua eficácia.

Por outro lado, a seleção destes três tópicos, com base nos quais a investigação é desenvolvida, teve fundamentalmente em conta que os acidentes de trabalho mais graves são os mortais e de que os padrões de causalidade entre acidentes de trabalho mortais e não mortais são diferentes, implicando, portanto, a adoção de diferentes estratégias para assegurar a eficácia da sua prevenção, ao contrário do que defendia Heinrich (1931) and Bird & Germain (1966), que acreditavam que actuando preventivamente na base da ‘pirâmide dos acidentes’ se preveniria também a sua ocorrência no topo, conforme defende Hale (2001) e notou Jacinto, Almeida, Antão, & Soares (2007). Baseou-se também na aparente inconsistência entre a tese geralmente aceite de que a organização dos serviços de segurança e saúde no trabalho é susceptível de contribuir para a melhoria das condições de segurança e de saúde dos trabalhadores nos locais de trabalho e, desta forma, para a redução de acidentes de trabalho (COWI, 2015) e que justificou, de resto, a opção do legislador português por tornar obrigatória a organização e o funcionamento destes serviços pelos empregadores (Portuguese Parliament, 2009a:article 73), e a preocupante constatação de que, dos 145 acidentes de trabalho mortais registados em Portugal em 2014, 115 (cerca de 79%) ocorreram em estabelecimentos que tinham os serviços de segurança e saúde no trabalho organizados, o que levanta sérias dúvidas sobre a natureza e a eficácia dos sistemas de gestão da segurança e saúde no trabalho implementados nesses estabelecimentos. Considerou também a importância comumente reconhecida à avaliação da eficácia da inspecção do trabalho na prevenção dos acidentes de trabalho. Esta última, de resto, consubstanciada no pedido lançado pela OIT e pela IALI (International Association of Labour Inspection) para o desenvolvimento de instrumentos de medição de desempenho destinados a definir, monitorar, medir e comparar indicadores de desempenho aplicáveis à inspecção do trabalho, a fim de avaliar se as atividades estão orientadas na direção correcta e sugerir medidas tendentes a melhorar a sua eficiência e eficácia (ILO, 2006c; Tösine & Wedege, 2013). Teve ainda em conta a necessidade acrescida sentida pelas inspecções do trabalho, enquanto organismos da administração pública, de prestarem contas aos contribuintes e aos respectivos *stakehol-*

ders sobre o valor acrescentado da sua actuação e sobre os *outcomes* fornecidos (Tösine & Wedege, 2013). Sobretudo num contexto de crescentes dificuldades das inspeções do trabalho em assegurarem o cumprimento da lei, não só devido às consequências no mundo do trabalho decorrentes da actual tendência para a desregulamentação e para a flexibilização das relações laborais, induzida pela globalização, mas também devido às crescentes restrições de recursos com que se têm vindo a confrontar (European Parliament, 2014, 2015; ILO, 2006c; Johnstone & Quinlan, 2006; Liao & Chiang, 2012; Miranda & Dias, 2004).

Em face do exposto, o principal propósito da presente dissertação é contribuir para a melhoria da eficácia da prevenção dos acidentes de trabalho em Portugal.

Para tanto, são propostos os três caminhos inter-relacionados acima mencionados, entendidos como suscetíveis de contribuir para a melhoria da eficácia da prevenção dos acidentes de trabalho em Portugal e em torno dos quais a presente dissertação é estruturada: melhoria da eficácia da prevenção dos acidentes de trabalho mortais; melhoria da eficácia do sistema mandatário português de gestão da segurança e saúde no trabalho na prevenção dos acidentes de trabalho em Portugal; e melhoria da eficácia da ACT na prevenção dos acidentes de trabalho em Portugal.

No essencial, a presente investigação sustenta que a melhoria da eficácia da prevenção dos acidentes de trabalho em Portugal é função da extensão com que a atenção dos decisores políticos e os recursos escassos das autoridades públicas competentes e dos demais actores do sistema nacional de prevenção dos riscos profissionais são focados nas (poucas) variáveis críticas que (melhor) explicam a eficácia da prevenção dos acidentes de trabalho mortais, a eficácia dos sistemas de gestão da segurança e saúde no trabalho na prevenção dos acidentes de trabalho e a eficácia da ACT na prevenção dos acidentes de trabalho.

Nesta conformidade, e relativamente à melhoria da eficácia da prevenção dos acidentes de trabalho, através da melhoria da eficácia da prevenção dos acidentes de trabalho mortais, foi utilizada uma amostra de 1.160 acidentes de trabalho (953 não mortais e 207 mortais) ocorridos em Portugal entre 1 de janeiro de 2013 e 22 de outubro de 2015, que foram objeto de inquérito de acidente de trabalho realizado pela ACT durante o mesmo período. Os resultados do modelo de regressão logística estimado revelam que o tipo de local de trabalho, desvio e lesão, assim como a dimensão do empregador, a sua idade e o seu tipo de vínculo laboral são preditores significativos da ocorrência de acidentes de trabalho mortais em Portugal. Os resultados mostram também que nem o sexo

do trabalhador nem o setor de atividade económica da entidade empregadora têm um efeito estatisticamente significativo na probabilidade de ocorrência de acidentes de trabalho mortais em Portugal. Estes resultados sugerem que a melhoria da eficácia da prevenção dos acidentes de trabalho em Portugal é função da extensão com que os recursos são concentrados na fiscalização e controlo das condições de trabalho de trabalhadores mais velhos, contratados sem termo por grandes empregadores para desenvolverem a sua atividade em locais de trabalho localizados em áreas de comércio, serviços ou indústria, expostos a desvios por transbordo, derrubamento, fuga, escoamento, vaporização ou emanação, suscetíveis de provocarem lesões músculo-esqueléticas, feridas, fraturas ou amputações.

No que concerne à melhoria da eficácia da prevenção dos acidentes de trabalho, através da melhoria da eficácia do sistema mandatário português de gestão da segurança e saúde no trabalho, foi utilizada uma amostra de 98 estabelecimentos nos quais, não obstante disporem de serviços de segurança e saúde no trabalho organizados, registaram acidentes de trabalho mortais em 2014. Os resultados do modelo de regressão linear múltipla estimado mostram que as variáveis estatisticamente significativas para explicar a eficácia do sistema mandatário português de gestão da segurança e saúde no trabalho na prevenção dos acidentes de trabalho são a dimensão do estabelecimento (em termos do número médio de pessoas que lá trabalham), a modalidade de organização dos serviços de segurança no trabalho adotada, o número de factores de risco físico a que se encontram expostos os trabalhadores e o setor de atividade económica principal do estabelecimento. Os resultados indicam também que a modalidade implementada de organização dos serviços de saúde no trabalho, o nível de cobertura das ações de informação, a dimensão do estabelecimento (em termos do número médio de trabalhadores das empresas subcontratadas, de trabalhadores temporários e de trabalhadores independentes que lá trabalharam), a organização de programas de promoção da saúde e a organização de programas de prevenção dos riscos profissionais não têm poder explicativo estatisticamente significativo para a eficácia do sistema mandatário português de gestão da segurança e saúde no trabalho na prevenção dos acidentes de trabalho. Os resultados da investigação sugerem ainda que a eficácia do sistema mandatário português de gestão da segurança e saúde no trabalho na prevenção dos acidentes de trabalho depende da extensão a que as autoridades competentes e outros atores do sistema nacional de prevenção de riscos profissionais focam os seus esforços e recursos nos seguintes aspetos essenciais: suporte técnico, *in situ*, para melhorar a implementação de sistemas de gestão

da segurança e saúde nos locais de trabalho (em detrimento da fiscalização do cumprimento de aspetos meramente formais); lançamento de campanhas de informação e de sensibilização sobre a avaliação e gestão dos riscos profissionais e sobre as modalidades e requisitos técnicos e legais da organização dos serviços de segurança e saúde no trabalho; fiscalização e controlo do cumprimento da legislação sobre avaliação dos riscos, implementação das medidas de prevenção adequadas e organização e funcionamento dos serviços de segurança e saúde no trabalho; e no reforço da fiscalização e controlo do cumprimento da legislação por parte dos estabelecimentos de maior dimensão que desenvolvem a sua atividade económica nos setores da indústria transformadora e da construção.

Quanto à melhoria da eficácia da prevenção dos acidentes de trabalho em Portugal por via da melhoria da eficácia da ACT na prevenção dos acidentes de trabalho, a eficácia da ACT foi aferida através da medição, com recurso à Análise Envoltória de Dados (DEA) da eficácia relativa dos seus 32 serviços desconcentrados, em termos do número de acidentes de trabalho (mortais e não mortais) e dias de ausência que estes ‘poupam’ por 100.000 trabalhadores, relativamente aos respetivos *benchmarks* europeus, tendo em conta os diferentes setores de atividade. Os resultados da investigação demonstram que a eficácia da ACT na prevenção dos acidentes de trabalho depende essencialmente dos seguintes factores: dimensão das áreas de jurisdição dos serviços desconcentrados (em termos do número de quilómetros quadrados); volume de população empregada nas áreas de jurisdição dos seus serviços desconcentrados; rácio respeitante ao número de trabalhadores servidos por inspetor de trabalho; volume da população empregada nos setores de atividade das respetivas áreas de jurisdição que expõem os trabalhadores a um maior nível de riscos profissionais e que, como tal, apresentam taxas de incidência de acidentes de trabalho mais elevadas; antiguidade média do pessoal afeto aos serviços desconcentrados; tempo afeto pelos diretores dos serviços desconcentrados à sua gestão; nível de educação e formação dos funcionários dos serviços desconcentrados (especialmente dos inspetores do trabalho); e natureza da abordagem e do gesto inspetivo adotados. Os resultados desta investigação sugerem ainda que a eficácia da prevenção dos acidentes de trabalho em Portugal poderia ser melhorada através das seguintes medidas: redesenho das áreas de jurisdição dos serviços desconcentrados da ACT (no sentido de assegurar uma afetação relativamente maior de recursos aos locais de trabalho de setores de atividade económica que expõem os trabalhadores a níveis mais elevados de riscos profissionais, reduzindo o rácio do número de trabalhadores servidos por inspetor

do trabalho nos locais de trabalho desses setores e aumentando o nível de especialização setorial); adoção de uma abordagem inspetiva mais próxima e mais especializada, designadamente através da criação de equipas inspetivas especializadas setorialmente e focadas principalmente na fiscalização e controlo do cumprimento da legislação laboral e de segurança e saúde no trabalho em locais de trabalho que operem em setores de atividade que exponham os respetivos trabalhadores a níveis mais elevados de riscos profissionais e que apresentem taxas de incidência de acidentes de trabalho mais elevadas (e.g. agricultura, silvicultura e pesca; indústrias extrativas; indústria transformadora; construção; comércio por grosso e a retalho; transporte e armazenagem; e setor das atividades administrativas e dos serviços de apoio); adoção de um gesto inspetivo mais focado no cumprimento substantivo do que no cumprimento de meros aspetos formais, baseado essencialmente numa abordagem mais pedagógica, em vez de exclusivamente sancionatória; lançamento continuado de campanhas de informação e de sensibilização especialmente focadas nos riscos mais importantes e nas medidas de prevenção mais adequadas para preveni-los, especialmente nos setores da indústria extrativa, comércio por grosso e a retalho, indústria transformadora (e.g., indústrias de vestuário, indústrias químicas, indústria da madeira e indústria agro-alimentar), construção e setor das atividades administrativas e dos serviços de apoio (e.g., assistência técnica, manutenção e limpeza); e adoção, pela ACT, de medidas e políticas de recursos humanos destinadas a melhorar o nível de educação e formação do pessoal dos serviços desconcentrados (especialmente dos inspetores do trabalho) e a combater o envelhecimento do pessoal (e.g., adaptação dos requisitos dos postos de trabalho, afetação de trabalhadores mais velhos a tarefas mais adequadas à sua idade e constituição de equipas de trabalho mistas em termos de idades).

É nossa expectativa que a presente investigação se possa constituir como um contributo válido para a melhoria da eficácia da prevenção dos acidentes de trabalho em Portugal e, concomitantemente, contribuir para colmatar as lacunas da investigação científica em Portugal neste domínio.

KEYWORDS: acidente de trabalho; OSHMS; inspeção do trabalho; eficácia; regressão; DEA

Abstract

The main purpose of this research is to contribute to work-related accidents (WRA) prevention effectiveness improvement in Portugal, through three key and interrelated effectiveness improvement paths, around which it is structured: fatal WRA prevention effectiveness; Portuguese Mandatory Occupational Safety and Health Management System (PMOSHMS) effectiveness in preventing WRA; and the ACT effectiveness in preventing WRA.

Regarding fatal WRA prevention effectiveness, the estimated logistic regression model indicates, based on 1,160 WRA occurred between 1/1/2013 and 22/10/2015 in continental Portugal, that type of workplace, deviation and injury, employer's size, worker's age and employment status are its significant predictors, suggesting that improving the WRA prevention effectiveness requires the resources concentration on monitoring elder permanent employees working in trade/services or industrial workplaces of large employers, exposed to deviations by overflow, likely to cause Musculoskeletal Disorders (MSD), wounds, fractures or amputations.

As for PMOSHMS effectiveness, the estimated multiple linear regression model shows, based on 98 establishments which, despite having Occupational Safety and Health (OSH) services, recorded fatalities in 2014, that establishment's size and sector, occupational safety services modality and number of physical risk factors are its significant explanatory variables, indicating that the improvement of the WRA prevention effectiveness mainly depends on the focus of resources on *in situ* OSH technical support; substantive compliance monitoring; OSH campaigns; enforcement of regulations on risk assessment and OSH services; and monitoring large manufacturing and construction establishments.

Concerning ACT's effectiveness, its Data Envelopment Analysis effectiveness model suggests that improving the WRA prevention effectiveness requires redesigning the branches jurisdiction areas in function of the volume of workers in workplaces of sectors with higher WRA incidence rates; reducing workers/labour inspectors ratio; strengthening staff education and training; tackling workforce ageing; adopting a more specialized, closer and pedagogical inspection approach; focusing on substantive compliance; targeting workplaces of sectors presenting higher WRA incidence rates; and implementing OSH campaigns.

KEYWORDS: work-related accident; OSHMS; labour inspection; effectiveness; regression; DEA

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Abbreviations List

ACC	American Chemistry Council
ACT	Portuguese labour inspectorate or Portuguese Authority for Working Conditions (Autoridade para as Condições do Trabalho)
AIHA	American Industrial Hygiene Association
ANSI	American Standards Institute
API	American Petroleum Institute
BSI	British Standards Institution
CEFIC	Conseil Européen des Fédérations de l'Industrie Chimique
CES	Portuguese Economic and Social Council
DEA	Data Envelopment Analysis
EEAT	Estatísticas Europeias de Acidentes de Trabalho
EEC	European Economic Community
EHSMS	Environmental, Health and Safety Management System
EMS	Efficiency Measurement System software
ESAW	European Statistics on Accidents at Work
ESAWCM	European Statistics on Accidents at Work Classification Methodology
EU	European Union
EU-OSHA	European Agency for Safety and Health at Work
GDP	Gross Domestic Product
GEP	Strategy and Planning Office of the Portuguese Ministry of Labour, Solidarity and Social Security
GNP	Gross National Product
HSE	Health and Safety Executive
IAEA	International Atomic Energy Agency
IALI	International Association of Labour Inspection
IBM	International Business Machines
ILO	International Labour Organization
INE	Portuguese Statistics National Institute
INRS	Institut National de Recherche et de Sécurité
IPQ	Portuguese Institute of Quality
ITSS	Inspección de Trabajo y Seguridad Social

LN	League of Nations
MASE	Manuel d'Amélioration de la Sécurité de l'Entreprise
MORT	Management Oversight and Risk Tree
MSD	Musculoskeletal Disorders
MTSSS	Portuguese Ministry of Labour, Solidarity and Social Security
OECD	Organization for Economic Co-operation and Development
OHS	Occupational Health and Safety
OHSAS	Occupational Health and Safety Assessment Series
OHSMS	Occupational Health and Safety Management System (Sistema de Gestão da Segurança e Saúde no Trabalho)
OIT	Organização Internacional do Trabalho
OSH	Occupational Safety and Health
OSHMS	Occupational Safety and Health Management System (Sistema de Gestão da Segurança e Saúde no Trabalho)
PMOSHMS	Portuguese Mandatory Occupational Safety and Health Management System
PNB	Produto Nacional Bruto
PNSPOSH	Portuguese National Strategy for the Promotion of Occupational Safety and Health
QUAR	Evaluation and Accountability Framework (Quadro de Avaliação e Responsabilização)
RIDDOR	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations
SGS	Système de Gestion de la Sécurité
SLIC	Senior Labour Inspectors Committee
SMEs	Small and Medium-sized Enterprises
SPSS	Statistical Package for the Social Sciences
SQAS	Safety and Quality Assessment System
UE	União Europeia
UK	United Kingdom
UN	United Nations
USA	United States of America
VPP	Voluntary Protection Program

WAIT	Work Accidents Investigation Technique
WHO	World Health Organization

Chapter 1 - Introduction

Chapter 1 - Introduction

1.1 The work-related death's paradox

The work plays a central role in the well-being and quality of life of people and their families, allowing means of subsistence and the strengthening of self-esteem, personal fulfilment and individual dignity, as well as the promotion of social cohesion and stability, peace and economic growth (Budd, 2011, 2013; Budd & Spencer, 2015; Danna & Griffin, 1999; Pontifical Council for Justice and Peace, 2004). It is now widely recognized, moreover, that the professional and personal lives of the people are not two separate entities, but rather areas interconnected and interrelated, with interactions between them (Caudron, 1997; Conrad, 1988; Zedeck & Mosier, 1990).

Paradoxically, and in clear contrast with the central role and importance commonly recognized to work, the International Labour Organization (ILO) holds that work kills more people than wars (ILO, 2005:5).

Indeed, and from a global workforce of around 2.84 billion people, it is estimated that about 2.4 million people die annually due to accidents at work (between 350 and 360 thousand deaths in about 270 million accidents at work) and occupational diseases (about 2 million deaths) (Hämäläinen et al., 2009; J. Takala et al., 2014; Jukka Takala, 2005).

Alli (2008) noted, in this connection, that in sub-Saharan Africa die annually 54 thousand employees of work-related causes and that there are approximately 42 million accidents at work per year resulting in at least 3 days of absence. He also observed that in Latin America and the Caribbean occur annually about 30 thousand deaths from work-related causes and approximately 22.6 million work accidents with absences of at least 3 days.

In the European Union (EU), according to the latest Eurostat (2016) European Statistics on Accidents at Work (ESAW), in 2014 occurred about 3.18 million work-related accidents with 4 or more days of absence (corresponding to an incidence rate of 1,536.25) and 3,739 fatal work-related accidents (incidence rate of 1.81).

In Portugal, the fatal and non-fatal work-related accidents numbers and incidence rates continue to be substantially higher than in the majority of the EU 28 countries. Regarding the fatal work-related accidents, for example, Portugal showed in 2014 the eighth largest number (160) of the EU 28 countries and the fifth highest incidence rate

(3.56), which is almost the double of the respective EU 28 average (about 97% higher). As for the non-fatal work-related accidents, Portugal presented in 2014 the fifth largest number (130,153) of the EU 28 countries and the second highest incidence rate (2,892.6), which is around 88% higher than the respective EU 28 average (Eurostat, 2016).

Moreover, and according to the data on fatal work-related accidents occurred in continental Portugal reported to and investigated by the ACT, 142 persons were victims of fatal work-related accidents in 2015; 141 people died due to work-related accidents in 2016; and, just between 1 January and 1 March 2017, 11 people had already been victims of fatal work-related accidents (ACT, 2017b).

In addition, the trend towards the decrease of the work-related accidents that was being watched in Portugal until 2012 began to show very worrying signs, remarkably with the apparent stagnation, during 2013 and 2014, of the decreasing trend of the fatal work-related accidents number and the increase, within that same period, of the number and incidence rate of the non-fatal work-related accidents (Eurostat, 2016).

Besides their deeply damaging consequences for the victims and their families, particularly at human and financial levels, work-related accidents also have harmful consequences for the employers and the States, resulting from their respective direct and indirect costs, whose value can reach up to 4% of their Gross National Product (GNP) (Bird & Germain, 1966, 1986; EU-OSHA, 1998; Fabela & Sousa, 2012; Hämäläinen et al., 2009; HSE, 2015; Leigh, 2011; J. Takala et al., 2014; Jukka Takala, 2005).

The growing awareness and serious concerns about the relatively high number and incidence rates of work-related accidents in Portugal and the emergency of their fight, has already led to: the definition of the reduction of the number and of the incidence rates of work-related accidents in Portugal, as the primary strategic goal of the Portuguese National Strategy for the Promotion of Occupational Safety and Health (PNS-POSH) for 2015-2020 (Portuguese Government, 2015e); the stipulation of promoting the reduction of accidents at work as the primary strategic objective of the ACT, within its strategy for 2013-2015 (ACT, 2014b) and for 2017-2020 (ACT, 2017c), as well as on its Activities Plans for 2016 (ACT, 2015a) and for 2017 (ACT, 2016a); the specification by the ACT, in its 2016 and 2017 Evaluation and Accountability Framework (QUAR), as its primary objective, to promote the reduction of accidents at work, with a key performance indicator target of visiting 70% of the employers who registered fatal or non-fatal accidents at work in the previous year (ACT, 2015b, 2016b). It also encour-

aged the joint organization by the ACT and the Spanish Labour and Social Security Inspectorate (Inspección de Trabajo y Seguridad Social - ITSS) of the undergoing Iberian Campaign for the Prevention of Accidents at Work 2016-2017 (ACT & ITSS, 2016).

1.2 Definition of the theme, its justification and relevance

The theme of this doctoral thesis is ‘Work-related accidents in Portugal: contributions to the improvement of prevention effectiveness’.

This theme is developed and structured around three main and interlinked topics, here understood as pathways that may lead to the improvement of the effectiveness of the fight against work-related accidents in Portugal: improving the effectiveness of the prevention of fatal work-related accidents, through the identification and targeting of resources in their predictors; improving the effectiveness of the Portuguese Mandatory Occupational Safety and Health Management System (PMOSHMS) in preventing work-related accidents, by identifying and concentrating the resources in its critical success factors; and improving the ACT’s effectiveness in preventing work-related accidents, by identifying and focusing the resources on its effectiveness drivers.

The selection of the topics on the basis of which the research is carried out took into account that the most serious work-related accidents are the fatal ones, as well as the fact that the causality patterns between fatal and non-fatal work-related accidents are different, implying therefore different strategies to ensure their prevention effectiveness, contrary to Heinrich (1931) and Bird & Germain (1966), who defended that acting preventively on the base of the ‘pyramid of accidents’, would also yield equally positive results at its top, as argued by Hale (2001) and noted by Jacinto, Almeida, Antão, & Soares (2007). It was also based on the apparent inconsistency between the generally accepted thesis that the organization of OSH services is likely to contribute to the improvement of the workers’ OSH conditions in workplaces and, in this way, to the reduction of work-related accidents (COWI, 2015), which justified, moreover, the option of the Portuguese legislator to make the organization and operation of these services mandatory to the employers (Portuguese Parliament, 2009a:article 73), and the disturbing finding that of the 145 fatal work-related accidents recorded in Portugal in 2014, 115 (about 79%) occurred in establishments that had OSH services organized, which raises serious questions about the nature and effectiveness of the OSH management systems implemented in these establishments. It also considered the commonly recognized im-

portance of assessing the effectiveness of labour inspectorates in preventing work-related accidents, consubstantiated, moreover, in the call launched by both the International Association of Labour Inspection (IALI) and the ILO, for the development of performance-measuring tools intended to define, to monitor, to measure and to compare labour inspection indicators, in order to assess if the labour inspectorates' activities are aimed at the right direction and to suggest measures to improve their efficiency and effectiveness (ILO, 2006c; Tõsine & Wedege, 2013). It also took into account the growing need felt by the labour inspectorates, as public administration bodies, to report to taxpayers and their stakeholders on the added value and outcomes provided (Tõsine & Wedege, 2013), especially in a context of increasing difficulties in ensuring compliance with the law, not only because of the consequences in the world of labour coming from the current trend towards the deregulation and flexibilization of the labour relations, but also due to the resource constraints with which they are being increasingly confronted (European Parliament, 2014, 2015; ILO, 2006c; Johnstone & Quinlan, 2006; Liao & Chiang, 2012; Miranda & Dias, 2004).

The relevance of the thesis theme derives, first and foremost, from the fact that it aims, in essence, to contribute to the improvement of the work-related accidents prevention effectiveness, in order to promote a better compatibility between, on the one hand, the right and the need to work, to produce and to prosper and, on the other hand, the right and obligation to preserve and promote the life, health, physical integrity and well-being of workers. Indeed, and following the pioneering work initiated by Pope Leo XIII in the late 19th century, about the condition of the workers, through his encyclical letter *Rerum Novarum* (Leo XIII, 1891) on capital and labour, and responding to the challenge launched by ILO (ILO, 1999, 2001c, 2004, 2008) and also embraced, later on, by the European Union (European Commission, 2006a; European Parliament, 2007), of making decent work a reality for all, the present research seeks to find ways which enable to improve the effectiveness and efficiency of the fight against the work-related accidents pandemic in Portugal, with the ultimate goal of being able to contribute to the reduction of deaths, injuries and other adverse consequences caused by accidents at work.

The relevance and emergency of this theme also stems from the fact that, in Portugal, the numbers and incidence rates of fatal and non-fatal work-related accidents continue to be substantially higher than those presented by most European partners and, in particular, from the concerns arising from the the verification, starting in 2013, of a slight

reversal of the declining trend that these indicators had been presenting in the last decades.

The importance of the proposed theme is also rooted, as will be seen later, in the manifest scarcity of literature on this subject, in spite of the recognition by the European Commission (2014) and by the ILO (2017), of the relevance of collecting, examining and providing reliable and timely statistical data, scientific studies and monitoring tools in the field of work-related accidents, in order to improve the quality of policy decisions in this area. The latter, incidentally, justified the fact that the ILO's campaign for the 2017 World Day for Safety and Health at Work focuses on the critical need for countries to improve their capacity to collect and utilize reliable OSH data (ILO, 2017). In fact, and despite the valuable contributions found during the literature review carried out within the framework of this research, and to the best of our knowledge, there are no scientific studies on, specifically, the predictors of fatal work-related accidents in Portugal or on the effectiveness of our mandatory OSH management system in the prevention of occupational accidents. Moreover, in the literature review conducted in the scope of the present research, besides the commonly recognized gap in the international research on the effectiveness of Occupational Safety and Health Management Systems (OSHMS) in preventing occupational accidents, particularly in view of their small number, methodological limitations and mixed and inconclusive results (Frick et al., 2000; Gallagher & Underhill, 2012; Robson et al., 2007; Stolk et al., 2012), it was found no empirical study, journal article or report regarding the effectiveness of OSHMS in the prevention of (fatal or non-fatal) work-related accidents in Portugal. In addition, and despite the aforementioned IALI and ILO calls for the development of performance-measuring tools to assess labour inspectorates' performance (ILO, 2006c; Tösiene & Wedege, 2013), it was found no study, journal article or publication on labour inspectorates' performance assessment, aimed at assessing quantitatively the efficiency and effectiveness of labour inspectorates, through a single composite measure and accounting for the simultaneous use of multiple input, output and outcome indicators with endogenous choice of weights.

In this context, it is our expectation that this research can help filling the gap in the scientific research in Portugal on this field and be a valid contribution to the improvement of the work-related accidents prevention effectiveness in Portugal.

1.3 Research questions

The preceding sections have made clear the urgent need to improve the effectiveness of the fight against the pandemic of work-related accidents, in order to preserve life, to protect the health and to promote the welfare of workers in workplaces.

Considering the fact that the most serious accidents at work are the fatal ones and that causality patterns between fatal and non-fatal work-related accidents are different, thus implying that different prevention strategies should be applied in order to ensure their effectiveness (Hale, 2001; Jacinto et al., 2007),

considering that, in spite of the generally accepted thesis that the organization of OSH services is likely to contribute to the improvement of the workers' OSH conditions in workplaces and in this way to the reduction of work-related accidents (COWI, 2015; Portuguese Parliament, 2009a), 115 (about 79%) of the 145 fatal work-related accidents recorded in Portugal in 2014 occurred in establishments that had OSH services organized, thus raising serious questions about their effectiveness,

considering that is reasonable to assume that the labour inspectorates, provided with the necessary resources and carrying out their duties effectively should be able to positively influence the OSH conditions at the workplaces and consequently, to produce positive outcomes, in particular in terms of reducing the number of work-related accidents (Anderson, 2007; Frick, 2011; ILO, 2007; Jensen, 2004; Levine, Toffel, & Johnson, 2012; Niskanen, Louhelainen, & Hirvonen, 2014; Richthofen, 2002; Suard, 2016; Tösine & Wedege, 2013), and

taking into account the above mentioned need for bridging the research gaps on these particular topics, the present research aims at answering the following set of research questions:

1. What are the variables which better explain or predict the occurrence of fatal work-related accidents in Portugal? What are the nature and direction of their associations with the occurrence of fatal accidents at work in Portugal? Based on such predictors, what are the estimated probabilities for the occurrence of fatal work-related accidents in Portugal?
2. Why do the Portuguese mandatory OSHMS fail in preventing the occurrence of work-related accidents? What are the main explanatory variables for such failure? How can the PMOSHMS effectiveness in preventing work-related accidents be improved?

3. Is it possible to assess the ACT's efficiency and effectiveness in preventing the occurrence of work related accidents in Portugal, both at national and regional levels? If so, it is possible to identify its efficiency and effectiveness drivers and to highlight possible improvement paths, in order to induce the reduction of accidents at work incidence rates in Portugal?

1.4 Research general goals

The main general goal of the present research is to contribute to the improvement of the effectiveness of the work-related accidents fight in Portugal, with a view to contribute to the ultimate goal of reducing the work-related accidents in Portugal.

It is also expected that this research can be a valuable contribution to bridging the gap of scientific research on the fatal work-related accidents' predictors in Portugal, on the main critical (un)success factors of the PMOSHMS in preventing work-related accidents and on the labour inspectorates' performance assessment in tackling accidents at work in Portugal.

1.5 Research specific goals

Besides the attainment of the main general goals laid down above, this research also pursues the achievement of the following specific goals:

1. To identify the (few) variables that (better) explain and predict the occurrence of fatal work-related accidents in Portugal and that (more) contribute (positively or negatively) to the probability of their occurrence, which are hereby understood as the true 'critical success factors' of the fight against fatal work-related accidents in Portugal, by reference to Kenichi Ohmae (1982).
2. To examine the nature and direction of the associations between the identified predictor variables and the occurrence of fatal accidents at work in Portugal.
3. To develop models which allow estimating the probability of fatal accidents at work occurrence in Portugal.
4. To find the main critical (un)success factors for the PMOSHMS effectiveness in preventing work-related accidents, in order to enable, in a highly strategic perspective, to concentrate on them the attention of policy makers and to focus on them the efforts and the scarce resources of the competent public authorities and

of other bodies and actors of the national system for the prevention of occupational risks, so as to ensure the fierce and determined combat to the inhibitors of PMOSHMS effectiveness which tend to induce the increase of accidents at work in Portugal.

5. To assess the ACT's performance in preventing work-related accidents in Portugal, both at national and regional levels.
6. To clarify the ACT's local branches efficiency and effectiveness drivers in preventing work-related accidents.
7. To identify possible paths to improve ACT's efficiency and effectiveness in preventing accidents at work in Portugal, in order to optimize its contribution to their reduction.

It aims, essentially, to identify the critical factors for the improvement of the work-related accidents prevention effectiveness in Portugal (e.g., fatal work-related accident's predictors, critical (un)success factors of the PMOSHMS effectiveness and Portuguese labour inspectorate effectiveness drivers in preventing accidents at work), which must constitute the focus of the efforts, resources and attention from the national competent public authorities and other bodies and actors of the national system for the prevention of occupational risks, in order to enhance the effectiveness and efficiency maximization in the war against work-related accidents in Portugal.

Indeed, and considering the resource constraints with which governments in general and labour inspectorates in particular are being increasingly confronted (European Parliament, 2014, 2015; ILO, 2006c; Liao & Chiang, 2012), it is paramount to concentrate the scarce resources at their disposal where its effect is more significant, in accordance with the teachings of ancient military strategists, as T'ai Kung or Sun Tzu, later popularized and put into practice by famous warlords and guerrillas such as Julius Caesar, Attila, Frederick II of Prussia, Napoleon Bonaparte, Carl Von Clausewitz, Von Nguyen Giap, Mao Tse-Tung or Liddell Hart and, more recently, adopted and incorporated in management by several authors and contemporary researchers such as Al Ries (1996), Kenichi Ohmae (1982) and Michael Porter (1998). It is, in essence, to put into practice, in the fight against the pandemic of work-related accidents, the understanding of the famous Prussian general Clausewitz (1908), according to which there is no law so mandatory or simple to strategy that keep the forces concentrated because, as he advocated, by concentrating the forces in the decisive point to obtain superiority over the enemy (even with the risk to be at the disadvantage in other points) the success in this

crucial point will offset any weakness allowed in others. In line, by the way, with Porter (1998), when he warns that wanting to be everything to everybody is a recipe for strategic mediocrity, or with Ries (1996), when he maintains that resources, due to its very scarce nature, should be judiciously concentrated where its effect is more powerful and useful.

1.6 Structure and organization of the study

This research starts with the present chapter 1, within which the theme is properly framed and defined, its choice and relevance are justified and its research questions, general and specific goals and structure are presented.

It follows a generic literature review (chapter 2). Besides the description of the main used search sources, this chapter reviews the most relevant literature on work-related accidents (e.g., concept, taxonomy and their main characteristics in the 28 countries of the European Union (EU 28) and in Portugal), causes, circumstances and predictors of work-related accidents, main consequences of work-related accidents, OSH international legal framework, Portuguese OSH legal framework, OSHMS, the role of the labour inspection in promoting OSH and preventing work-related accidents and the labour inspectorates' performance assessment, concluding with the identification of some important research gaps. This generic literature review is further deepened afterwards, in its more detailed aspects, within the later development of each specific research topic (in chapters 3 to 5).

In order to better fulfill its purposes, and bearing in mind the dissertation theme, its research questions and the aforesaid goals, this research is then structured around three main interrelated topics, understood as three possible improvement paths for the effectiveness of the fight against work-related accidents in Portugal: predictors of the fatal work-related accidents in Portugal (in chapter 3); critical (un)success factors of the PMOSHMS effectiveness in preventing work-related accidents (in chapter 4); and Portuguese labour inspectorate effectiveness in preventing work-related accidents (in chapter 5). Each of these chapters, in turn, is also organized with a structure identical to the doctoral thesis itself, being composed roughly by the following sections: summary, introduction, literature review and research hypotheses, results presentation and discussion, concluding remarks, main policy implications, main limitations and possible paths for further research.

Moreover, each of these chapters is intended or was already submitted for publication to peer reviewed indexed scientific journals. A shorter version of the research on the topic ‘Contributions to the improvement of fatal work-related accidents’ prevention effectiveness in Portugal: predictors and occurrence probabilities’ (chapter 3) is currently pending review, following its submission for publication, in September 1st, 2016, to the *International Labour Review*, an ILO journal on labour market institutions and economics, with peer review, indexed by Scopus (SJR Quartile: Q2; SJR: 0.445; IF: 0.812). Similarly, an extract of the research on the topic ‘Critical factors of the Portuguese mandatory occupational safety and health management system effectiveness in preventing work-related accidents’ (chapter 4) is currently under review, following its submission for publication, in October 14th, 2016, to the Elsevier journal *Safety Science*, an international journal on science and technology of human and industrial safety, with peer review, indexed by Scopus (SJR Quartile: Q1; SJR: 0.928; IF: 2.157). In addition, a shorter version of the research on the topic ‘Labour inspectorates’ efficiency and effectiveness assessment as a learning path to improve work-related accidents prevention’ (chapter 5) is currently being prepared and is expected to be submitted soon for publication, to a peer reviewed and indexed international journal on operations research or on operations management (e.g., *Omega*, *Operations Research*, *Journal of the Operational Research Society*, *European Journal of Operational Research*, *International Journal of Operations & Production Management* or *Journal of Productivity Analysis*).

It is worth mentioning, at this stage, that the development of the research on each of the above mentioned research topics required the use of different data analysis methods along with the use of different data analysis software. In fact, while in the chapter 3 topic it was used a logistic regression with the Maximum Likelihood method for the estimation of the model parameters and the *IBM SPSS* software, version 21, in the chapter 4 research topic it was used the multiple linear regression with the Least Squares method (with the White heteroskedasticity correction) to estimate the model parameters, along with the use of the the econometric *EViews* software, version 7.1, Enterprise Edition, in order to carry out the confirmatory analysis. As for the chapter 5 research topic, it was used the DEA non-parametric methodology for performance assessment, whereas the DEA problems were solved through the use of the *EMS (Efficiency Measurement System)* software, version 1.3.0.

The research finishes with chapter 6, which is devoted to the synthesis of the main conclusions of the overall research, their policy implications, as well as to the identifica-

tion of its main limitations and to the recommendation of several possible, interesting and useful paths for future research.

Chapter 2 - Literature Review

Chapter 2 - Literature Review

Considering the purposes of this research, its general and specific goals and, consequently, the three main topics on which it is focused (fatal work-related accidents predictors, critical factors of the POSHMS effectiveness and labour inspectorates' performance assessment), the literature review carried out within the scope of this research targeted mainly the following subjects: work-related accidents (concepts, statistics, consequences, causes and predictors), OSHMS (concept, nature and effectiveness), international and national labour and OSH legal frameworks and labour inspection role and performance assessment in preventing work-related accidents. Subsidiarily, it was also developed some literature review, instrumental in nature, on subjects more closely linked to methodological aspects, in particular, regarding scientific research methodologies and data analysis methodologies (e.g. logistic regression, multiple linear regression and DEA).

It involved the query of several data bases and electronic literature search engines, namely the RCAAP (Open Access Scientific Repository of Portugal), the Registry of Open Access Repositories (ROAR), the Directory of Open Access Repositories (OpenDOAR), the Directory of Open Access Books (DOAR), the Google Scholar and the Portuguese Online Knowledge Library (b-on Consortium Portugal). The latter provides access to full texts of thousands of scientific journals and eBooks, of some of the most important content providers for research and higher education institutions (e.g. Elsevier, Wiley, SAGE, Springer, Emerald, Academic Search Complete, Business Source Complete, Current Contents of Thompson Reuters, ERIC Education Resource Information Center, Library, Information Science & Technology Abstracts, Psychology and Behavioral Sciences Collection, Regional Business News, Web of Science, Medline, MedicLatina).

It also involved performing several bibliographical searches in the Knowledge Resource Center of the ACT (integrated into the Knowledge Resources Network coordinated by the National Centre for Qualification of Trainers of the National Employment and Vocational Training Institute) and in the International Knowledge Network on Health and Safety at Work of the ILO (CIS Network), as well as the use of several research networks for scientists and researchers, such as ResearchGate, Mendeley and Academia.edu.

In addition, it also required reviewing the most relevant international and national labour and OSH regulations and examining several ACT internal regulations, guidelines, studies, publications, working papers and management documents and data.

The following literature review is further deepened, in its more precise aspects, within the later development of the research on each of the three abovementioned main topics.

2.1 Work-related accidents

2.1.1 The concept of work-related accident and its taxonomy

In general, an accident can be defined as an unexpected, unforeseen and undesirable occurrence resulting in injury, death, loss or damage to property or the environment, caused by a complex combination of permanent elements (danger factors) with variable elements in time and space (risk factors) which correspond to exposure conditions and to the trigger event (Goguelin, 1996; Roxo, 2004). In addition, when the accident does not produce personal injury, it is called an incident; when it does cause neither personal injury nor property damage, it is called alternatively ‘almost accident’ or ‘near miss’ (Roxo, 2004).

To the ILO (1998:1), accident at work is *an unexpected and unplanned occurrence, including acts of violence, arising out of or in connection with work which results in one or more workers incurring a personal injury, disease or death.*

According to the Portuguese law, accident at work is defined as that which occurs at the place and time of work and produces directly or indirectly personal injury, functional disorder or disease resulting in the reduction in working capacity or for gain or death (Portuguese Parliament, 2009e:article 8, paragraph 1). It is still considered as an accident at work, as foreseen in Portuguese Parliament (2009e:articles 8 and 9), the accident resulting in reduced capacity for work or for gain or death which occurs:

1. In travel, transport or movement, because or in the course of work or performing tasks for the employer.
2. In the route normally used by the worker, in either direction, between any of their workplaces (if he has more than one employer), between his place of work or training and his usual or occasional residence, the place where he normally takes

meals, the place where he usually receives his salary, the location where is provided to the employee assistance or treatment due to previous accident or the location where he provides his work by determination of the employer.

3. In the execution of services spontaneously provided and which may result in economic benefit for the employer.
4. In the workplace and outside of it, when in the exercise of the right of assembly or activity of workers ' representative.
5. In the workplace, when in frequency of vocational training course or outside the workplace, when there is express permission from the employer for such frequency.
6. In the place of payment of the salary.
7. In the place where the worker should receive any form of assistance or treatment because of previous accident.
8. In job search activity during the credit hours legally provided.
9. Out-of-place or working time, when in the execution of certain services determined by the employer or by him allowed.

Considering the nature and severity of the consequences associated with work-related accidents, the national and international legislation and practice tend to distinguish a few types of accidents at work: the fatal ones; and the non-fatal. The latter, moreover, are usually further decomposed in the ones that cause incapacity for work exceeding three working days; the serious; and those who show a particularly serious situation in terms of OSH conditions.

2.1.1.1 Fatal work-related accident

The fatal accident at work is the one whose victim dies within a certain period of time from the date of its injury. While in Portugal this time period is a year, there are countries in which the accident at work is considered deadly if the victim died on the day of the accident (Netherlands), in the period of 30 days (Germany) or even without any limit of time period (Austria, Belgium, France, Greece, Italy, Luxembourg, Norway and Sweden) (Eurostat, 2001; GEP, 2015).

2.1.1.2 Non-fatal work-related accident

The non-fatal work-related accident is understood, in Portugal, as the one that causes a injury to an employee which does not die within a year from the date of the injury (Eurostat, 2001; GEP, 2015).

2.1.1.2.1 Non-fatal work-related accident that causes incapacity of more than 3 days

According to the Eurostat (2001:14) ESAW methodology, the OSH Framework Directive (European Council, 1989a:article 9, paragraph c) concept of ‘absence from work of more than 3 working days’ is interpreted as considering only full working days of victims absence from work (excluding the day of the accident) and, consequently, ‘more than 3 days’ means, in practice, ‘at least 4 days’. As such, only accidents with a resumption of work not before the fifth day after the day of the accident or later should be included (or considered as a work-related accident). Moreover, the ‘number of days lost’ has to be counted beginning with 4 days lost, if the resumption of work takes place at the fifth day following the day of the accident, 5 days lost if the resumption occurs at the sixth day, and so on.

This issue is particularly important, when interpreting and comparing statistics on work-related accidents because, depending on their origin and, consequently, on the criteria used, they might refer to different situations.

In fact, and as noted the Strategy and Planning Office (GEP) of the Portuguese Ministry of Labour, Solidarity and Social Security (MTSSS), the ILO statistics, for example, consider the non-fatal work-related accidents that generate at least 1 day of absence, whereas the Eurostat, as seen above, considers the ones that generate at least 4 days of absence, while GEP considers them all, irrespectively of the number of days of absence from work (GEP, 2015:12-13).

As such, this issue was taken into account during the research on each of the three topics of the present study. Accordingly, it was expressly referred to in the respective sections, reserved for the methodology (in particular, in the sections relating to the description of the data used), what criteria was applied to accidents at work in terms of their geographical scope, as well as what criteria was used (in terms of the number of days of absence from work) for their consideration as non-fatal accident at work.

2.1.1.2.2 Serious non-fatal work-related accident

Although the number of days of incapacity for work resulting from an accident at work can be a proxy for its severity level, these are insufficient to classify a work-related accident as serious. In addition, the Portuguese legislation does not define specifically what a ‘serious accident at work’ is. It merely refers to accidents at work ‘evidencing serious physical injury’ (Portuguese Parliament, 2009a:article 111, paragraph 1) or ‘resulting in serious worker injury’ (Portuguese Government, 2003b:article 24, paragraph 1) without, however, specifying which injuries should be considered ‘serious’. In this context, the concept of a serious work-related accident has come to be understood in Portugal as the one that causes serious injury to workers, in the sense of serious physical injury advocated by the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) (UK Government, 2013) of the United Kingdom (ACT, 2016e).

Accordingly, serious work-related accidents in Portugal are commonly considered to be occupational accidents resulting in the following ‘serious physical injuries’ to workers (ACT, 2016e; UK Government, 2013):

1. A fracture, other than to fingers, thumbs and toes;
2. Amputation of an arm, hand, finger, thumb, leg, foot or toe;
3. Permanent loss of sight or reduction of sight;
4. Crush injuries leading to internal organ damage;
5. Serious burns (covering more than 10% of the body, or damaging the eyes, respiratory system or other vital organs);
6. Any degree of scalping (separation of skin from the head) requiring hospital treatment;
7. Unconsciousness caused by head injury or asphyxia;
8. Any other injury arising from working in an enclosed space, which leads to hypothermia, heat-induced illness or requires resuscitation or admittance to hospital for more than 24 hours.

2.1.1.2.3 Non-fatal work-related accident which shows a particularly serious situation

The Portuguese legislation does not expressly define what is an ‘accident at work which shows a particularly serious situation’ (Portuguese Government, 2000a:article 10,

paragraph 1e) or that ‘is particularly serious in terms of occupational safety’ (Portuguese Government, 2003b:article 24, paragraph 1).

Notwithstanding the above, it is generally accepted that a non-fatal work-related accident which shows a particularly serious situation or that is particularly serious in terms of occupational safety is the one who causes serious physical injury (in accordance with defined in the previous section) or injury of a worker requiring specialized medical treatment in a health facility (including those resulting from physical violence) or that, regardless of the personal injury caused or the number of days of incapacity caused, reveal a particularly serious situation from the perspective of safety and health at work (SST), with reference to the following serious situations relating to health and safety identified by the RIDDOR (ACT, 2016e; UK Government, 2013):

1. The collapse, overturning or failure of load-bearing parts of lifts and lifting equipment;
2. The failure of any closed vessel or of any associated pipework (other than a pipeline) forming part of a pressure system;
3. Any explosion or fire caused by an electrical short circuit or overload;
4. Plant or equipment coming into contact with overhead power lines;
5. Any unintentional explosion, misfire of explosives, projection of material beyond the boundary of the site on which the explosives are being used or the failure of shots to cause the intended extent of collapse or direction of fall of a structure in any demolition operation;
6. Any accident or incident which results or could have resulted in the release or escape of a biological agent likely to cause severe human infection or illness;
7. The malfunction of breathing apparatus during testing immediately prior to use;
8. The failure or endangering of any lifting equipment associated with a diving operation, the trapping of a diver, any explosion in the vicinity of a diver and any uncontrolled ascent;
9. The complete or partial collapse of a scaffold or working platform;
10. Carrier equipment failure or collision or derailment of cars or trains;
11. Dangerous occurrence in wells, cesspools or deposits;
12. Dangerous occurrence in pipelines;
13. Collision or overturning of a tanker carrying dangerous substances, irrespective of the release of the substances or the occurrence of a fire;
14. Fire or release of dangerous substance transported by road;

15. The unintentional collapse or partial collapse of any structure any floor or wall of any place of work, arising from, or in connection with, ongoing construction work (including demolition, refurbishment and maintenance), whether above or below ground;
16. Explosion or fire causing work to be stopped for more than 24 hours;
17. Sudden, unintentional and uncontrolled release inside a building of 100 kilograms or more of a flammable liquid, 10 kilograms or more of a flammable liquid at a temperature above its normal boiling point or 10 kilograms or more of a flammable gas;
18. Sudden, unintentional and uncontrolled release in the open air of 500 kilograms or more of a flammable liquid or gas;
19. The unintentional release or escape of any substance which could cause personal injury.

2.1.2 Work-related accidents in the EU 28

The work-related accidents scenario in the EU 28, although not as dramatic as the one that can be seen in other parts of the world, it is, nonetheless, likely to cause serious concerns.

Table 1 summarizes the numbers and incidence rates of the fatal and non-fatal work-related accidents occurring in the EU between 2008 and 2014.

DESCRIPTION	2008	2009	2010	2011	2012	2013	2014
Fatal work-related accidents							
Number	4,736	4,294	4,449	4,141	3,918	3,674	3,739
Incidence rate (per 100,000 workers)	2.39	2.01	2.11	2.05	1.95	1.8	1.81
Non-fatal work-related accidents							
Number	3,851,698	3,529,946	3,581,628	3,414,735	3,165,414	3,127,546	3,176,640
Incidence rate (per 100,000 workers)	1,939.9	1,653.84	1,697.58	1,689.69	1,575.91	1,533.39	1,536.25

Table 1 - Fatal and non-fatal work-related accidents in the EU 27/28 (2008-2014)

Fonte: Own elaboration, based on Eurostat (2016) data.

Notes:

1. The figures for 2008 and 2009 do not include Croatia;
2. The non-fatal work-related accidents refer to the ones which caused at least 4 days of absence from work.

According to the latest Eurostat (2016) ESAW data, as can be seen in Table 1, the total number of fatal and non-fatal work-related accidents in the EU 28 in 2014 was around 3.18 million, of which 3,739 proved to be fatal.

Table 1 allows us to see that, during the period under review, both the numbers as the incidence rates of fatal and non-fatal work-related accidents in the EU 28 present a

sharp and consolidated trend of descent, although with a slight rise, in relation to the previous year, in 2010 and 2014.

2.1.3 Work-related accidents in Portugal

Portugal has been also showing, in recent years, a clear tendency of decrease in the absolute number and incidence rates of fatal and non-fatal work-related accidents, with the exception of the year 2011, when there was a slight rise, in relation to the previous year, in the incidence rates of the fatal and non-fatal work-related accidents, as can be seen in table 2.

DESCRIPTION	2008	2009	2010	2011	2012	2013	2014
Fatal work-related accidents							
Number	221	213	204	192	169	160	160
Incidence rate (per 100,000 workers)	5.25	4.21	4.1	5.07	4.8	3.61	3.56
Non-fatal work-related accidents							
Number	147,349	135,102	130,271	125,912	113,179	123,137	130,153
Incidence rate (per 100,000 workers)	3,501	2,673.13	2,616.85	3,322.19	3,215.62	2,780	2,892.6

Table 2 - Fatal and non-fatal work-related accidents in Portugal (2008-2014)

Fonte: Own elaboration, based on Eurostat (2016) data.

Notes:

1. The figures for 2008 and 2009 do not include Croatia;
2. The non-fatal work-related accidents refer to the ones which caused at least 4 days of absence from work.

It should be noted, however, that there is an apparent stagnation in 2013 and 2014 of the downward trend in the number of fatal work-related accidents, as well as a worrying reversal of the downward trend in the number and incidence rates of non-fatal work-related accidents, as shown in Table 2.

In addition, in 2014, Portugal continues to present numbers and incidence rates of fatal and non-fatal work-related accidents which are substantially higher than the ones presented by the majority of the EU 28 countries. Regarding the fatal work-related accidents, Portugal presents the eighth highest number (160) and the fifth highest incidence rate (3.56), which represents almost twice (about 97% higher) of the EU 28 average incidence rate of fatal work-related accidents. As for the non-fatal work-related accidents, Portugal presents the fifth largest number (130,153) and the second highest incidence rate (2,892.6), which is around 88% higher than the EU 28 average incidence rate of non-fatal work-related accidents (Eurostat, 2016).

Regarding the sectoral distribution of the fatal work-related accidents occurring in Portugal in 2014 per economic activity, the Eurostat (2016) ESAW data indicates that the economic activity sectors that present higher number of fatal work-related accidents

are the following: Construction (about 27% of the total); Agriculture, forestry and fishing, and Manufacturing (both with around 16%); Transportation and storage (11%); Wholesale and retail trade (9%); Administrative and support service activities (8%); and Mining and quarrying (4%). When considering the fatal work-related accidents incidence rates (instead of their absolute numbers), the situation changes slightly, with the following sectors presenting fatal work-related accidents incidence rates higher than the Portuguese average incidence rate: Mining and quarrying (48.79 fatalities per 100,000 workers, which is almost 14 times the Portuguese average incidence rate of fatal work-related accidents); Construction (15.59); Transportation and storage (10.26); Water supply; sewerage, waste management and remediation activities (9.59); Administrative and support service activities (8.07); Agriculture, forestry and fishing (6.43).

As for the distribution per economic activity sector of the number of non-fatal work-related accidents occurred in Portugal in 2014, the Eurostat (2016) ESAW data reveals that the economic activity sectors that show a higher number of non-fatal work-related accidents are the following: Manufacturing (about 27% of the total number of non-fatal accidents at work); Wholesale and retail trade and Construction (both with around 15%); Administrative and support service activities (7%); Transportation and storage, Human health and social work activities, and Accommodation and food service activities (all with about 6%); Agriculture, forestry and fishing (5%); and Public administration and defence (4%). When considering the non-fatal work-related accidents incidence rates (rather than the number of accidents), the ranking of the sectors changes, with the following sectors presenting incidence rates higher than the Portuguese average incidence rate of non-fatal work-related accidents: Construction (6,980.77, which is almost two and a half times the Portuguese average incidence rate); Water supply; sewerage, waste management and remediation activities (5,968.03); Mining and quarrying (5,870.11); Administrative and support service activities (5,717.45); Transportation and storage (4,763.17); Manufacturing (4,719.87); Accommodation and food service activities (3,002.55); and Wholesale and retail trade (3,001.52).

Moreover, considering the distribution of the accidents at work per employers' size (in terms of the number of employees), the 2014 Eurostat (2016) ESAW data on Portugal allows us to see that, in general, the lower the size of the employer, the higher its number of both fatal and non-fatal accidents at work. In fact, the data indicate that, of the total number of fatal work-related accidents recorded in Portugal in 2014, the majority (about 37%) victimized workers of micro employers (with between 1 and 9 employ-

ees), 29% victimized workers of small employers (with between 10 and 49 workers), 16% victimized workers of medium-sized employers (with between 50 and 249 workers), 8% victimized workers of very large employers (with more than 500 workers) and 4% victimized workers of large employers (with between 250 and 499 workers). In the case of the non-fatal accidents at work, most of the victims was employed in micro employers (about 26% of the total), in small employers (25%), medium-sized employers (20%) and in very large employers (18%).

As for the distribution of the accidents at work occurring in Portugal in 2014 by age groups, Eurostat (2016) ESAW data allows us to observe that the majority of the victims of fatal and non-fatal work-related accidents, although with small differences on the respective weights, belongs to the age group between 25 and 54 years (around 74% in the case of fatal occupational accidents and 77% in the non-fatal ones), followed by the group of workers over 55 years of age (23% *versus* 14%, respectively) and, finally, by the group of workers under 25 (3% *versus* 8%).

In what concerns the distribution of the work-related accidents occurring in Portugal in 2014 per workers' sex, the ESAW data indicates that the victims of accidents at work are mainly male workers: about 96% in the case of fatal work-related accidents; and 72% in the case of the non-fatal ones (Eurostat, 2016).

2.2 Causes, circumstances and predictors of work-related accidents

The occurrence of work-related accidents strongly suggests the existence of dysfunctions and non-conformities in OSH at the workplaces (ILO, 2003).

Although unexpected, unanticipated and undesirable, the work-related accidents do not occur spontaneously, but as a result of a set of logical and real causes (Nunes, 2010). More often, due to a multiplicity of causes and, in most cases, tend to emerge from deeper problems than those identified as their direct causes (Roxo, 2004).

The identification, study and understanding of these causes have proved to be an indispensable tool for understanding the accident (Nunes, 2010), as well as for isolating or eliminating the factors that contributed to their occurrence (Roxo, 2011), for better designing preventive and protective measures (Nunes, 2010) and for boosting the establishment of benchmarks and standards that allow the implementation of adequate strategies of intervention (Roxo, 2011).

As such, a considerable amount of research has been developed on the causes and circumstances of accidents at work, since the pioneering research of Greenwood & Woods (1919) on the individual susceptibility (or propensity) for accidents.

Notably, through the Heinrich (1931) research on the five factors sequential model, proposed to explain the causal and pre-established sequence of industrial accidents (heredity and social environment, personal defects, unsafe acts and/or mechanical or physical hazards, the accident itself, and the damage), within the causal determinism approach. This research was later deepened by Bird (1974), through extending substantially its object (to also include incidents, occupational illnesses and mental health of workers), the scope of causality (to include, in addition to the traditional immediate causes, the mediate ones, particularly those more closely related to the various aspects of business management) and the nature of the factors (to include economic factors such as productivity, quality, etc.). Accordingly, the occurrence of accidents would result from the succession of other five factors (lack of control or management, root causes or origins, immediate causes or symptoms, accident or contact, and damage or loss) (Bird, 1974; Bird & Germain, 1966). The collaboration between the two would still be marked by the development of the so-called ‘pyramid of accidents’ and the resulting thesis that prevention action at its base level would yield equally positive results at the top of the pyramid (Bird, 1974; Bird & Germain, 1966; Heinrich, 1931). Bird & Germain (1986) would be still attached to the study and demonstration of the economic advantages of preventing accidents at work, through the quantification of their direct (visible) and indirect (invisible) costs, whose relationship (1 to 5) is often illustrated analogically via the popular iceberg of Bird.

Other important contribution to the body of science was given by the epidemiological model of accidents, popularized by Gordon (1949), according to which the accidents at work are explained by the simultaneous presence of three sets of contingent factors: the aggressor agent; the target (host), and the exposure (in terms of time, amount and means or environment of hazard propagation). In this perspective, the damage does not occur in the absence of the agent, the target or the exposure, insofar as one of the factors is missing (be null), the product will also be, therefore prevention and control can be carried out on any of these factors or combinations thereof.

It is also important to highlight the sociotechnical approaches, which are essentially systemic and contingent in nature. According to such approaches, organizations are understood as open (considering their relation to their external environment) and compo-

site systems (integrating multiple subsystems, namely a technical subsystem, an organizational subsystem and a social subsystem) whose interactions are likely to help to explain the dysfunctions underlying the occurrence of work-related accidents (Roxo, 2004).

Within the systemic accidentological models, it is worth mentioning the MORT (Management Oversight and Risk Tree), developed by William Johnson in 1975 and often used as an analytical and systematic method of determining the causes of major accidents, on the basis of a diagram called the 'risk tree'. According to this methodology, the undesirable event (work-related accident or incident) is explained as an undesirable transfer of energy causing injury, damage or degradation of a process, through the logical combination of a set of omissions with weaknesses of management and control of specific factors (Monteau & Favaro, 1990). It is also importante to mention in this field, the contributions of Goguelin (1996), regarding the understanding of the accident as a system composed of two subsystems (the primary and secondary accidents), as well as the contributions of Perrow (1999), who proposed the understanding of the accidents as a result of the nature of the interactions (linear or complex) between its components and the complexity and precision of its connections (open or tight coupling).

With regard to the organizational subsystem, its relevant to highpoint the followig contributions: the sequential accidentological model recommended by Turner & Pidgeon (1997), which is based on six consecutive stages (starting point, incubation period, precipitating or detonator event, beginning of the accidental process, emergency measures, and cultural readjustment); the explanation of the accidents occurrence based on control failures or emergencies, due to the organization's inability to respond to risk factors, as proposed by Cardella (1999); and the understanding of the work-related accidents proposed by Reason (1997), as a result of the combination of organizational factors (eg, strategic decisions, organizational culture and policies, planning, organization, information and control systems), factors of the workplace (eg, communication, application of superior decisions, productive process, type of work, specific physical activity, machinery, equipment and materials, workstation, work environment, training, information, supervision, retribution, work pace, procedures and protection measures installed) and workers' unsafe acts.

As far as the sociological approaches are concerned, it is important to stress the contribution of Dwyer (1991), in particular regarding the explanation of work-related accidents based on how the individual relates to the organization in terms of rewards (e.g.,

recognition, financial rewards in return for work and their effects in terms of exposure to risk), of command (e.g., chain of command, leadership ability, communication and information, and his ability to conform behaviors) and of organization (e.g., production process, type of work, division and rotation of tasks, workstation, work pace, specific physical activity, training, experience, level of education, knowledge and skills). Also worthy of note is the thermostat model proposed by Adams & Thompson (2002), according to which the behavior of the worker is moderated by the cost-benefit analysis that he necessarily does (although not always consciously) between the inducing factors of greater or lesser risk exposure (namely the level of rewards and the perception of risk) with its consequences (the probability of occurrence of an accident at work and the resulting injury, incapacity or death).

It should also be mentioned, in the context of the sociotechnical approaches, the contribution of Bellamy & Geyer (1992), with respect to the model of the 'sociotechnical pyramid' that they proposed, according to which the accidents at work might be explained through an ascending hierarchy of logical causes, from the most remote to the most direct, based essentially on five variables which are understood as the most likely to induce their occurrence (system climate, organization and management, communication, information and control of results, human reliability and technical reliability).

Building on the above mentioned contributions, the research is being oriented, more recently, towards the identification of more comprehensive variables of personal, socio-economic, organizational and situational nature, aimed at estimating the work-related accidents occurrence probabilities, in order to allow the upstream adoption of more effective and efficient policies and measures to tackle their occurrence and to minimize their consequences (Jacinto et al., 2007; Nunes, 2010; Roxo, 2004).

The latter include variables such as: worker's sex (Cordeiro, Clemente, Diniz, & Dias, 2005; Rommel, Varnaccia, Lahmann, Kottner, & Kroll, 2016; Zangirolani, Cordeiro, Medeiros, & Stephan, 2008); worker's age (Rommel et al., 2016); worker's employment status (Gallagher & Underhill, 2012; Gallagher, Underhill, & Rimmer, 2001; Lippel et al., 2011; Nenonen, 2011; Probst & Brubaker, 2001; Quinlan, Johnstone, & McNamara, 2009; Quinlan, Mayhew, & Bohle, 2001; Quinlan & Mayhew, 2000; Rebitzer, 1995; Santana, Maia, Carvalho, & Luz, 2003; Underhill & Quinlan, 2011; Zangirolani et al., 2008); worker's level of completed education (Lima, Victora, Dall'Agnol, Facchini, & Fassa, 1999; Spangenberg et al., 2003); worker's monthly family income (Lima et al., 1999); worker's learning process of the profession

and training (Spangenberg et al., 2003; Stave & Törner, 2007); worker's experience and attitudes (Spangenberg et al., 2003); human failures of diagnosis and decision making (O'Connor & O'Connor, 2005, 2006); organization and working methods (O'Connor & O'Connor, 2005, 2006; Stave & Törner, 2007); lack of communication, deficiencies in technical / physical means, stress caused by the mismatch between the level of responsibility and control, conflict between objectives and inconsistency between standards and practices (Stave & Törner, 2007); employers' economic activity sector (Eurostat, 2001; Jacinto et al., 2007); employer's size (Eurostat, 2001; Jacinto et al., 2007; Laird, Olsen, Harris, Legg, & Perry, 2011; Legg, Olsen, Laird, & Hasle, 2015; Micheli & Cagno, 2010; Sørensen, Hasle, & Bach, 2007; Yorio & Wachter, 2014), particularly in the case of small and medium-sized enterprises (SMEs), whose specific characteristics are argued to induce higher work-related accidents incidence rates (Baldock, James, Smallbone, & Vickers, 2006; Enrico Cagno, Micheli, & Perotti, 2011; Champoux & Brun, 2003; Eurostat, 2001; Gallagher et al., 2001; Hasle, Kines, & Andersen, 2009; Hasle, Kvorning, Rasmussen, Smith, & Flyvholm, 2012; Hasle & Limborg, 2006; Hasle, Limborg, Kallehave, Klitgaard, & Andersen, 2012; Jacinto et al., 2007; Laird et al., 2011; Legg et al., 2015; Mayhew & Peterson, 1999; Micheli & Cagno, 2010; Morse et al., 2004; Okun, Lentz, Schulte, & Stayner, 2001; Olsen et al., 2010; Sørensen et al., 2007; Stevens, 1999; Targoutzidis et al., 2014; David Walters, 2006); ESAW 'type of workplace' (Eurostat, 2001); ESAW types of 'deviation' and 'injury' associated to the accident (Eurostat, 2001), namely the types of deviations 'loss of control (total or partial) of machine, means of transport or handling equipment, hand-held tool, object or animal' and 'slipping - stumbling and falling - fall of persons', and the type of injury 'wounds and superficial injuries' (Jacinto et al., 2007).

2.3 Main consequences of work-related accidents

Work-related accidents have profoundly devastating consequences to their victims and respective families, especially at human level (e.g. death, injuries, disabilities, decreased quality of life, pain, sorrow, suffering and self-esteem issues) and financial level (e.g. loss of earnings and earning capacity) (Fabela & Sousa, 2012; HSE, 2015; Richthofen, 2002; Roxo, 2004).

In addition, they also have high direct and indirect costs to the employers and to the States. The former include, among others, the costs related to health, emergency ser-

vices, social security benefits, insurance premiums and compensation; costs with the rehabilitation and reintegration of the victims; costs of repairing the damages produced in plant, machinery, equipment, and raw materials; costs arising from possible civil and criminal liability; etc. The latter comprise, inter alia, loss of tax revenue and social security; damage to the reputation and image of the organizations and countries; costs with the recruitment and training of replacements of the affected workers; impact on the motivation, absenteeism and presentism of the colleagues of the victim; reduction of production capacity and productivity; impact on the quality of goods and services and delivery times; diseconomies of scale and experience; opportunity costs; inspection and investigation costs; administrative costs; etc. (Bird & Germain, 1966, 1986; Fabela & Sousa, 2012; Freitas, 2004; Heinrich, Petersen, & Roos, 1980; HSE, 2015; Nunes, 2010; Richthofen, 2002; Roxo, 2004; Sérgio Miguel, 2010; J. Takala et al., 2014).

As such, several studies have been devoted to quantifying the direct and indirect costs arising from accidents at work to the State, employers and victims.

Miller (1997) estimated them at about US\$155 billion for the United States (USA) employers, while Leigh (2011), as noted Takala et al. (2014), estimated that the national cost of occupational injuries and diseases in the United States (USA) amounted to US\$250 billion (1.8% of the USA Gross Domestic Product - GDP).

Richthofen (2002) situated the respective direct costs in the EU at about EUR€26 billion and the ILO calculated that the annual costs of accidents at work and occupational diseases reach the amount of US\$1200 billion, representing about 4% of global GNP (Hämäläinen et al., 2009; J. Takala et al., 2014; Jukka Takala, 2005).

The European Agency for Safety and Health at Work (EU-OSHA), on the basis of the data collected from Member States of the EU, estimated the costs associated with accidents at work and occupational diseases in EU countries between 0.4% e 4% of the respective GNP, whereas about 0.4% of GNP in Ireland and in Portugal; 0.6% in France; 1.4% in Austria; between 1.3% and 2.5% of the GNP in Luxembourg; 2.3% in Belgium; 2.6% in the Netherlands; 2.7% in Denmark; about 3% in Spain; 3.2% in Italy; 3.8% in Finland; and 4% in Sweden) (EU-OSHA, 1998).

The Health and Safety Executive (HSE), on the other hand, estimated the total costs arising from accidents at work and occupational diseases occurring in the United Kingdom between 2013 and 2014 (including not only the associated financial costs but also the human costs) at about EUR€18.1 billion (HSE, 2015).

2.4 OSH international legal framework

The consequences of the pandemic phenomena of work-related accidents discussed above have encouraged policy makers around the globe to take action in order to promote the improvement of safety and health conditions at work and to prevent the occurrence of work-related accidents.

As a result, international community has been involved in joint efforts at international, regional, national and local levels, in order to promote safety and health at work and, in this way, prevent the occurrence of accidents at work. Those efforts are being carried out both within the main reference organizations in the field in which they are integrated, such as the United Nations (UN), the ILO, the World Health Organization (WHO), the Organization for Economic Co-operation and Development (OECD) and the EU, and through bilateral, multilateral and tripartite processes of negotiation and consultation between the various stakeholders (in particular among Governments, employers' and workers' representative associations and civil society representatives).

These international efforts, moreover, have been fleshing out in international guidelines, norms and standards, mainly in the form of international treaties, covenants, declarations, charters, conventions and community directives, whose implementation is understood as likely to contribute to the improvement of health and safety in the workplaces and, consequently, to the reduction of accidents at work and occupational diseases (Alli, 2008; European Council, 1989a; European Parliament, 2015; ILO, 1981, 2006a, 2007). They reflect the understanding that poor working conditions, in terms of safety and health at work, decrease productivity and competitiveness, as accidents at work and occupational diseases have direct and indirect adverse consequences on the lives of workers, their families and employers, whereas safe and healthy work, on the contrary, have significant positive impacts on the productivity and competitiveness of companies and countries themselves (European Parliament, 2015; ILO, 2007).

They also reveal the belief that the absence of high levels of protection of safety and health of workers may result in absenteeism due to the occurrence of accidents at work and occupational diseases, leading to permanent disabilities which, from the point of view of the social and economic costs, often supported by the respective social security systems and public finances, foreshadows considerable impact on Member States (European Parliament, 2015; Portuguese Government, 2008d).

It is worth to mention, in this connection, the preamble of ILO's Constitution of 1919, embodying the ILO's mandate to protect workers against sickness, diseases and injuries at work (ILO, 1919), and the articles 100 and 118 of the Treaty of Rome (establishing the European Economic Community), which provide for Community intervention at the level of safety and health at work and the adoption of policies on employment, working conditions and protection against accidents and occupational diseases, giving the Commission the role of ensuring cooperation between Member States in these fields (EEC, 1957).

Regarding international covenants, it should be noted, for example, the article 7 of the International Covenant on Economic, Social and Cultural Rights, which provides for the right of all people to enjoy just and favorable working conditions that ensure, in particular, safer and healthy working conditions (UN, 1966).

As far as the international declarations are concerned, it is important to highlight, among others: the United Nations Universal Declaration of Human Rights, which foresees, in articles 23 and 24, the rights of all people *to work, to just and favorable conditions of work, to just and favorable remuneration supplemented, if necessary, by other means of social protection and to rest and leisure, including reasonable limitation of working hours and periodic holidays with pay* (UN, 1948); and the ILO Declaration of Philadelphia (Declaration Concerning the Aims and Purposes of the ILO, adopted at its 26th session General Conference, in May 10, 1944) in which the ILO assumes the obligation of supporting the implementation of programs aiming to *achieve an adequate protection of the life and health of workers in all occupations* (ILO, 1944:paragraph III-g).

Moreover, and concerning international charters, the Charter of Fundamental Rights of the European Union assumes special relevance, as it provides for, in its article 31, the right of all workers to *fair and just working conditions, namely to working conditions which respect worker's health, safety and dignity and to limitation of maximum working hours, as well as to daily and weekly rest* (EU, 2000). It is also important to mention, in this regard, the Community Charter of Fundamental Social Rights of Workers, which sets out, in point 19, the right of all workers to benefit from *satisfactory health and safety conditions in his working environment* and the need for the adoption of appropriate measures to ensure it, which must take into account the necessary *training, information, consultation and balanced participation of workers as regards the risks incurred and the steps taken to eliminate or reduce them* (EU, 1989).

With regard to international conventions, and besides the Convention of the League of Nations relating to slavery, adopted at Geneva on 25 September 1926 (LN, 1926), it also assumes special prominence, within the international and European OSH promoting legal framework architecture, the international labour standards set by the ILO Conventions No. 155, concerning OSH and the working environment and No. 187, concerning the promotional framework for OSH (ILO, 1981, 2006a).

The ILO Convention No. 155 sets out the principles for a national policy of safety and health at work, to be adopted by the ILO constituents, here understood as needed to prevent the occurrence of work-related accidents and health hazards arising from work (ILO, 1981). It also defines the actions to be undertaken at national level (e.g. implementation of a system to supervise and enforce the application of the law on safety and health at work; definition of worker processes that should be forbidden or conditioned; establishment, where necessary, of the rules relating to the design, construction, organization, exploitation and transformation of companies and materials used; and provision of the legal obligation of notification, full inquiry and annual publication of statistical data on occupational accidents and diseases). It recognizes the need to ensure the enforcement of OSH legislation through an appropriate and sufficient inspection system (which should provide for the application of penalties in case of non-compliance with the legal provisions) and to provide advice to employers and workers in order to assist them in fulfilling their legal obligations. It also sets, at company level, the OSH obligations of both employers and employees.

The promotional framework for OSH Convention No. 187, on the other hand, is aimed at establishing a coherent, systematic and continuous improvement system to promote OSH, in order to prevent occupational injuries, diseases and deaths (ILO, 2006a). The foreseen framework, that should be adopted by the ILO constituents, consists in the combination of a national policy to promote safer and healthier working environments with a national system (composed by laws, regulations, responsible authorities, technical information, advice, training, education, OSH services, research and collection of data on accidents and diseases) and national OSH programs (which should define priorities, time frames, means of action and performance assessment procedures).

In addition to the abovementioned ILO conventions, it is also important to stress the importance of other OSH related ILO conventions, namely the following: No. 81, on labour inspection in industry and commerce; No. 129, on labour inspection in agriculture; No. 150, on labour administration: role, functions and organization; No. 115, on

radiation protection; No. 120, concerning hygiene in commerce and offices; No. 139, on the prevention and control of occupational hazards caused by carcinogenic substances and agents; No. 148, on working environment - air pollution, noise and vibration; No. 162, on safety in the use of asbestos; No. 176, on safety and health in mines; and No. 184, on safety and health in agriculture (ILO, 1947, 1960, 1964, 1969, 1974, 1977, 1978, 1986, 1995, 2001a).

Regarding the European OSH promoting legal framework, it assumes special prominence the European Council Directive No. 89/391/EEC, of 12 June 1989, concerning the introduction of measures to encourage improvements in the safety and health of workers at work (European Council, 1989a) and its subsequent special directives, as well as the EU Strategic Framework on Health and Safety at Work 2014-2020 (European Commission, 2014).

The EU directives in the field of OSH, are intended essentially to harmonize the conditions of health and safety at work at EU level, in order to ensure the proper compatibility between economic and social progress, avoiding that competition within the EU can be done at the expense of workers' safety and health, through the establishment of minimum safety and health at work requirements (European Council, 1989a).

The European Council Directive No. 89/391/EEC, establishes the European legal framework for the promotion of OSH at workplaces, which is often understood as a mandatory OSHMS for EU Member Countries (European Council, 1989a; Karageorgiou, Jensen, Walters, & Wilthagen, 2000; David Walters, 2002). Based on the understanding that the workers can be exposed to dangerous environmental factors at the workplace and that the incidence of accidents at work and occupational diseases were still too high, the Council had considered that preventive measures should be taken in order to safeguard the safety and health of workers and ensure a higher degree of protection, through the implementation of OSH minimum requirements across the EU. In essence, it defines the principles regarding the prevention of occupational risks, the protection of safety and health, the elimination of risk and accident factors, the practices of informing, training, consulting and ensuring the participation of workers, as well as the employers and workers obligations in respect to the implementation of those principles. The general principles of prevention, as laid down in paragraph 2 of article 6 of the framework Directive, include, according to the following hierarchical order: to avoid risks; to evaluate the risks which cannot be avoided; to combat the risks at source; to adapt the work to the individual; to adapt to technical progress; to replace the dangerous

by the non-dangerous or the less dangerous; to develop a coherent overall prevention policy which covers technology, organization of work, working conditions, social relationships and the influence of factors related to the working environment; to give collective protective measures priority over the individual ones; and to give appropriate instructions to the workers (European Council, 1989a). The worker's obligations involve essentially taking care of his own safety and health and that of other persons affected by his actions, to make correct use of work equipment and personal protective equipment and to cooperate with the employer and other workers. Regarding the employers, and besides the non-transferability of their responsibility for the safety and health of their workers in every aspect related to the work, their obligations include, *inter alia*: risk's assessment and prevention; provision of information and training; provision of the necessary internal or external OSH services organization and means; to take the necessary measures for first aid, fire-fighting and evacuation of premises; to consult workers; and to ensure that workers receive appropriate health surveillance (European Council, 1989a).

In addition to the framework Directive No. 89/391/EEC, the EU OSH acquis also comprises around 30 individual directives, focusing on specific aspects of OSH and tailoring the principles of that framework directive to specific tasks (e.g. manual handling of loads), specific hazards at work (e.g. exposure to dangerous substances or physical agents), specific workplaces and sectors (e.g. temporary work sites, extractive industries, fishing vessels), specific groups of workers (e.g. pregnant women, young workers, workers with a fixed duration employment contract) and certain work-related aspects (e.g. organisation of working time). Among these individual directives, it is worth to highlight the following: 89/654/EEC, on workplace requirements; 89/656/EEC, on personal protective equipment; 90/269/EEC, on manual handling of loads; 90/270/EEC, on work with display screen equipment; 91/322/EEC, 98/24/EC and 2000/39/EC, on exposure to chemical agents; 91/383/EEC, on fixed-duration or temporary employment relationship; 92/29/EEC, on medical treatment on board vessels; 92/57/EEC, on temporary or mobile construction sites; 92/58/EEC, on safety and/or health signs; 92/85/EEC, on pregnant workers; 92/91/EEC, on mineral-extracting industries (drilling); 92/104/EEC, on mineral-extracting industries; 93/103/EC, on work on board fishing vessels; 94/33/EC, on young workers; 1999/92/EC, on the risks from explosive atmospheres; 2000/39/EC, 2006/15/EC and 2009/161/EU, on indicative occupational exposure limit values; 2000/54/EC, on the exposure to biological agents at work;

2002/44/EC, on exposure to mechanical vibration; 2003/10/EC, on exposure to noise; 2004/37/EC, on carcinogens or mutagens at work; 2006/25/EC, on exposure to artificial optical radiation; 2009/104/EC, on the use of work equipment; 2009/148/EC, on exposure to asbestos at work; 2010/32/EU, on prevention from sharp injuries in the hospital and healthcare sector; 2013/35/EU, on exposure to electromagnetic fields; and 2013/59/Euratom, on protection against ionising radiation (European Commission, 1991, 2000, 2006b, 2006c, European Council, 1992b, 1992c, 1992d, 1992e, 1992f, 1993a, 1994, 1998, 2010, 2014, 1989b, 1989c, 1990a, 1990b, 1991, 1992a, European Parliament & European Council, 2000a, 2000b, 2002, 2003, 2004, 2009a, 2009b, 2013a, 2013b).

As far as the EU Strategic Framework on Health and Safety at Work 2014-2020 (European Commission, 2014) is concerned, it addresses the following three major health and safety at work challenges: to increase the implementation of existing health and safety rules, mainly in micro enterprises and SMEs; to improve the prevention of work-related diseases; and to tackle the ageing of the EU's workforce. These main challenges, in turn, are expected to be addressed mainly through: the strengthening of national OSH strategies; the provision of practical support to micro enterprises and SMEs; the improvement of the EU legislation enforcement (e.g. by evaluating the performance of national labour inspectorates); the simplification of existing legislation; the consideration of the trend towards the ageing of EU workforce; the progress on statistical data collection; and the reinforcement of the coordination between the EU institutions and other international organizations (e.g., the ILO, the WHO and the OECD) and partners, in order to reduce work-related accidents and occupational diseases (European Commission, 2014).

2.5 Portuguese OSH legal framework

In Portugal, the legal framework on safety and health at work follows closely the international and European framework on OSH discussed earlier.

It is structured around the legal regime for the promotion of safety and health at work, approved by Law No. 102/2009, of 10 September (Portuguese Parliament, 2009a), with later amendments introduced by Law No. 42/2012, of 28 August (Portuguese Parliament, 2012), Law No. 3/2014, of 28 January (Portuguese Parliament,

2014a), Decree-Law No. 88/2015, of 28 May (Portuguese Government, 2015d), and Law No. 146/2015, of 9 September (Portuguese Parliament, 2015a).

In addition, it incorporates the OSH provisions of most ILO Conventions¹ and EU Directives² and the essential provisions of article 59 of the Constitution of the Portuguese Republic (Portuguese Parliament, 1976), as well as the provisions of articles 281 and 282 of the Portuguese labour code (Portuguese Parliament, 2009d).

This general law is applicable to all economic activities, within the private, cooperative and social sectors, as well as in the public administration, whenever special legal provisions do not foresee it differently³.

It acts as a kind of umbrella, with a series of special regimes articulated beneath it, regulating safety and health at work in specific situations, particularly in view of the nature of the risks to which the workers are (or can be) exposed (e.g. noise, mechanical vibrations, manual handling of loads, explosive atmospheres, serious accidents with hazardous substances, cut-perforating medical devices, optical radiation, ionizing radiation, chemical agents, carcinogenic or mutagenic agents, asbestos, biological agents, genetically modified micro-organisms and use of machines and work equipment)⁴ or the nature of the workplace and/of the economic activity sector concerned (e.g. minimum health and safety requirements applicable to workplaces, commerce and services

¹ Including all the eight fundamental conventions, all the four priority Conventions of governance (including Convention No. 81 concerning labour inspection in industry and commerce and Convention No. 129 on labour inspection in agriculture) and about 70 of 177 technical Conventions (including Convention No. 150 concerning labour administration: role, functions and organization and the Convention No. 155 on the safety and health of workers and the working environment).

² In particular of the following directives: 89/391/EEC, on the introduction of measures to encourage improvements in the safety and health of workers at work (as amended by Directive 2007/30/EC); 91/383/EEC, supplementing the measures to encourage improvements in the safety and health at work of workers with a fixed-duration employment relationship or a temporary employment relationship; 92/85/EEC, on the introduction of measures to encourage improvements in the safety and health of pregnant workers, workers who have recently given birth or are breastfeeding; 94/33/EC, concerning the protection of young people at work; 90/394/EEC, concerning the protection of workers from the risks related to exposure to carcinogens at work (as amended by Directive 97/42/EC and 1999/38/EC); 90/679/EEC, on the protection of workers from the risks related to exposure to biological agents at work (as amended by Directive 93/88/EEC); 98/24/EC, on the protection of the health and safety of workers from the risks related to chemical agents at work; 2006/123/EC, on services in the internal market; and 93/103/EC, concerning the minimum safety and health at work requirements on board fishing vessels (European Council, 1989a, 1990c, 1990d, 1991, 1992f, 1993b, 1994, 1997, 1998, 1999, European Parliament & European Council, 2006, 2007).

³ As results from the combination of paragraph 1-a) of article 3 of the legal framework for the promotion of occupational safety and health, approved by Law No. 102/2009, of 10 September (amended by Law No. 3/2014, of 28 January) with paragraph 1-i) of article 4 of the General Employment Law in Public Functions, approved by Law No. 35/2014, of 20 June (Portuguese Parliament, 2009a, 2014a, 2014b).

⁴ See, by the way, and respectively, the following enactments: Decree-Law No. 182/2006, of 6 September; Decree-Law No. 46/2006, of 24 February; Decree-Law No. 330/93, of 25 September; Decree-Law No. 236/2003, of 30 September; Decree-Law No. 254/2007, of 12 July; Decree-Law No. 121/2013, of 22 August; Law No. 25/2010, of 30 August; Decree-Law No. 222/2008, of 17 November; Decree-Law No. 24/2012, 6 February; Decree-Law No. 301/2000, of 18 November; Decree-Law No. 266/2007, of 24 July; Decree-Law No. 84/97, of 16 April; Decree-Law No. 55/2015, of 17 April; and Decree-Law No. 50/2005, of 25 February (Portuguese Government, 1993a, 1997b, 2012a, 2013, 2015c, 2000b, 2003a, 2005, 2006a, 2006b, 2007a, 2007b, 2008b; Portuguese Parliament, 2010).

establishments, industrial establishments, construction sites, mines and quarries and to the work on board fishing vessels)⁵.

Among the main aspects and characteristics of the Portuguese legal framework for the promotion of safety and health at work, with important implications on the promotion of healthy and safe working conditions and, in this way, in the prevention of occupational accidents, it is worth to highlight the following (Portuguese Parliament, 2009a):

1. It is guided by the following fundamental principles⁶:
 - a. The worker's right to work in conditions that respect his safety and health, provided by the employer or who manages the premises;
 - b. The employer's non-transferable obligation to ensure workers safety and health conditions in all aspects related to work, applying all the necessary prevention measures (including technical prevention, training, information and consultation of workers and the organization of internal or external OSH services) and considering the general principles of prevention⁷;
 - c. The works that may involve risks to the genetic heritage of the worker or their descendants are forbidden or conditioned;
 - d. Workers must comply with the requirements of safety and health at work laid down by law or determined by the employer;
 - e. The placing of economic development to the duty of promoting the humanization of work and of improving the health and safety working conditions;
 - f. The prevention of occupational risks must be based on a correct and constant risk assessment and be developed according to the principles, policies, rules and programs aimed at, in particular: the formulation and implementation of the national strategy for the promotion of safety and health at work (Portuguese Government, 2015e); the definition of the technical conditions

⁵ See, in this regard, and respectively: Decree-Law No. 347/93, of 1 October and Ministerial Ordinance No. 987/93, of 6 October; Decree-Law No. 243/86, of 20 August; Ministerial Ordinance No. 53/71, of 3 February (amended by Ministerial Ordinance No. 702/80, of 22 September); Decree No. 41821, of 11 August 1958, Decree No. 46427, of 10 July 1965, Ministerial Ordinance No. 101/96, of 3 April and Decree-Law No. 273/2003, of 29 October; Decree-Law No. 162/90, of 22 May, Decree-Law No. 324/95, of 29 November; Ministerial Ordinance No. 197/96, of 4 June and Ministerial Ordinance No. 198/96, of 4 June; Decree-Law No. 116/97, of 12 May; and Law No. 102/2009, of 10 September (Portuguese Government, 1958, 1965, 1996b, 1996c, 1997a, 2003b, 1971, 1980, 1986, 1990, 1993b, 1993c, 1995a, 1996a; Portuguese Parliament, 2009a).

⁶ Set out in article 5 of the legal framework for the promotion of occupational safety and health, approved by the Law No. 102/2009, of 10 September (Portuguese Parliament, 2009a) and in the general principles of OSH, defined in article 281 of the Portuguese labour code, approved by the Law No. 7/2009, of 12 February (Portuguese Parliament, 2009d).

⁷ Mentioned in the preceding section and listed in paragraphs 2-a) to 2-i) of article 15 of the Law No. 102/2009, of 10 September (Portuguese Parliament, 2009a) and initially enshrined in paragraphs 2-a) to 2-i) of article 6 of the framework Council Directive No. 89/391/EEC, of 12 June 1989 (European Council, 1989a).

governing the design, the manufacture, importation, sale, disposal, installation, organization, use and transformation of the material components of the work; the determination of substances, agents or processes that should be prohibited, limited or subject to authorization; the surveillance of workers' health; the development of technical and scientific research applied in the field of safety and health at work; education, training and information for the improvement of safety and health at work; the awareness of society, to promote a genuine culture of prevention; and the improvement of the effectiveness and efficiency of the public system of labour inspection.

2. The legal provision of the obligation of the State to promote the development of a national system (or network) for occupational risk prevention, in order to ensure the implementation of the right to safety and health at work, by safeguarding the coherence of the measures and the intervention effectiveness of public, private or cooperative entities which exercise powers and competencies in the areas of regulation, licensing, certification, standards, research, training, information, consultation and participation, technical services of prevention and health surveillance and inspection.
3. The imposition of a series of general obligations and behaviors to employers⁸, in accordance with articles 16 to 18 and 20 to 21 of ILO Convention No. 155 (ILO, 1981), articles 5 to 12 of the framework Directive 89/391/EEC (European Council, 1989a) and articles 281 to 284 of the Portuguese labour code (Portuguese Parliament, 2009d), namely: to ensure continuously and permanently safety and health conditions to workers in all aspects of their work, with strict observance of the general principles of prevention; to plan prevention as a coherent system that integrates the technical developments, the organization of work, working conditions, social relationships and the influence of environmental factors; to identify hazards, to assess risks and to integrate the results of these evaluations in all its activities, implementing the appropriate prevention and protection measures; to provide training, consultation and information in the field of OSH to workers and their representatives; to ensure the monitoring of the health of workers; to organ-

⁸ Most of them summarized in article 15 of the legal framework for the promotion of occupational safety and health, approved by the Law No. 102/2009, of 10 September (Portuguese Parliament, 2009a) and subsequently developed and fleshed out in subsequent articles, as well as in other legislation, already mentioned, regarding the exposure of workers to specific risks.

ize internal or external OSH services, mobilizing the necessary resources, in particular in the fields of prevention technical activities, training, information, as well as concerning the personal protective equipment that becomes necessary to use; and to ensure special protection to younger workers⁹, to pregnant workers, and to workers who have recently given birth or are breastfeeding¹⁰.

4. The assignment to the ACT of the powers, among others, to:
 - a. Monitor the compliance with the legislation relating to safety and health at work and impose the sanctions corresponding to its non-compliance; and
 - b. Conduct inquiries in the cases of fatal work-related accidents, accidents showing a particularly serious situation (ACT, 2016e) and occupational diseases.

Furthermore, and with regard to accidents at work and occupational diseases, the Portuguese legal framework also foresees the following (Portuguese Parliament, 2009d:article 283, paragraphs 1,5):

1. Workers and their families are entitled to compensation for damage arising from an accident at work or occupational disease.
2. The employer is obliged to transfer the responsibility for damages arising from accidents at work to entities legally authorized to perform this insurance.
3. The responsibility for compensation for damage arising from occupational diseases is assumed by the social security.
4. The employer's obligation to notify the ACT of the occurrence of fatal work-related accidents, as well as of those showing serious physical injury, as foreseen in ILO (1947:article 14), Portuguese Parliament (2009a:article 111, paragraph 1) and ACT (2016e), as follows:
 - a. Generally speaking, up to 24 hours after its occurrence, as provided for in Portuguese Parliament (2009a:article 111, paragraph 1).
 - b. In construction sites, work-related accidents resulting in death or serious injury or that assume particular gravity from the perspective of safety must be notified as soon as possible and may not exceed 24 hours, as set forth in Portuguese Government (2003b:article 24, paragraph 1).

⁹ Pursuant to the combination of paragraph 2 of article 72 of the Portuguese labour code (Portuguese Parliament, 2009d), with articles 61 to 72 of the Law No. 102/2009, of 10 September (Portuguese Parliament, 2009a).

¹⁰ As results from the conjunction of article 62 of the Portuguese labour code (Portuguese Parliament, 2009d) with articles 50 to 60 of the legal framework for the promotion of occupational safety and health at work (Portuguese Parliament, 2009a).

- c. In work on board fishing vessels, work-related accidents resulting in death or injury or that, regardless of the production of personal injury, shows a particularly serious situation for workers ' health or safety, shall be communicated as soon as possible, as provided for in Portuguese Government (1997a:article 8, paragraph 1).
- d. In extractive industries by surface or underground drilling, accidents at work resulting in death or serious injury, or that, regardless of the production of such personal injury, shows a particularly serious situation for workers ' health or safety, must be notified within 24 hours, in accordance with Portuguese Government (1995a:article 9, paragraph 1).

2.6 OSHMS

Notwithstanding the acknowledge relevance of ensuring safe and healthy working conditions, the debate over job quality and OSH conditions was delayed for quite some time, mainly due to the tendency for economy tertiarization, to the decrease of work-related accidents rates in industrialized countries and to the emergent concerns about the unemployment raise (Askenazy, 2004; Stolk et al., 2012).

The recent changes in the world of work, however, have provoked a growing concern regarding the apparent deterioration of the employment quality in recent decades (EU-OSHA, 2002a, 2009; European Commission, 2008; González, Cockburn, & Irastorza, 2010; Karoly & Panis, 2004; Stolk et al., 2012). In particular, regarding OSH conditions and their repercussion on work-related accidents incidence rates (Brun & Milczarek, 2007; EU-OSHA, 2002a, 2002b, 2009; Gallagher & Underhill, 2012; Leka et al., 2008; Quinlan & Mayhew, 2000). Indeed, these changes, resulting in the replacement of the stable and traditional single employer workplace for workplaces consisting of multiple employers (through subcontracting, temporary employment agencies, use of self-employed workers, part-time workers, etc.), steered a greater propensity for accidents at work and occupational diseases (European Parliament, 2014, 2015; Gallagher & Underhill, 2012) as well as an amplified difficulty for labour inspectorates to ensure compliance with the law in workplaces increasingly complex (European Parliament, 2014, 2015; Johnstone & Quinlan, 2006), whereas the traditional strategic approach for safety and health at work, essentially prescriptive, passive and fragmented in nature, adopted in late 1970 and early 1980 in several industrialized countries, revealed to be

ineffective in the prevention of accidents at work and occupational diseases (Frick & Wren, 2000; Stolk et al., 2012; David Walters, Wilthagen, & Jensen, 2002).

Nevertheless, the introduction in various countries of legislation on the management of safety and health at work (Palassis, Schulte, & Geraci, 2006; David Walters, 2002; David Walters & Jensen, 2000), the promotion, by private entities and Governments, of the adoption by the employers of voluntary schemes for the management of safety and health at work (Stolk et al., 2012) and the development, at national and international level, of standards and guidelines on the implementation of Occupational Safety and Health Management Systems (OSHMS) and the associated certification processes (Palassis et al., 2006; Zwetsloot, 2000), would lead to the development of a new strategic approach to ensure the management of safety and health at work in industrialized countries (Frick et al., 2000; David Walters, 2002; David Walters & Jensen, 2000), especially following the framework Directive No. 89/391/EEC, of 12 June 1989, on the introduction of measures to encourage improvements in the safety and health of workers at work (Frick et al., 2000; Hasle & Zwetsloot, 2011; Palassis et al., 2006; David Walters, 2002; David Walters & Jensen, 2000; Zwetsloot, 2000).

Among the main aspects of these new strategic approach to manage OSH, embodied in the principles and obligations foreseen by this framework Directive, it is worth to highlight the non-transferable obligation of the employer for ensuring the safety and health of workers in every aspect related to the work, to assess the risks to which they are exposed and to adopt the appropriate safety and health preventive and protective measures, in accordance with the general principles of prevention (European Council, 1989a). Other structuring elements of this new strategic approach to the management of safety and health at work include, for example: systematic control and management of risks in the workplace (Hasle & Zwetsloot, 2011); the understanding that the identification of hazards and the assessment and control of occupational risks should be addressed in a management perspective (Bluff, 2003; Frick & Wren, 2000; Stolk et al., 2012); the assumption that prevention of accidents at work and occupational diseases requires the involvement and accountability of employers and workers in a systematic process of occupational risk management in the workplace (Frick et al., 2000; Frick & Wren, 2000; Saksvik & Quinlan, 2003; David Walters et al., 2002); the need for the OSH policy to be integrated into the employers' other management processes (Stolk et al., 2012); ensuring adequate information, training, consultation and participation of workers on safety and health at work: assigning workers to occupational risk preven-

tion; ensuring the existence of an internal structure of first aid, fire-fighting and evacuation of facilities; keeping updated records about the risk assessments and on accidents at work and occupational diseases; and the foreseen worker's prerogatives for submitting proposals on health and safety at work, applying to the competent public authorities and stop immediately their activity in the event of serious and imminent danger (European Council, 1989a; Stolk et al., 2012).

Although this framework Directive did not explicitly oblige the implementation of an OSHMS, Hasle and Zwetsloot (2011) noted that not only the nature of its principles and obligations are components of many OSHMS but also that the observance of these principles and the fulfilment of such obligations necessarily imply the adoption of a OSHMS.

Indeed, and despite the absence of a consensual definition of OSHMS (Nielsen, 2000; Gallagher *et al.*, 2001; Robson *et al.*, 2007), the framework directive elements, when taken together, can be seen as a mandatory OSHMS for the EU 28 countries (European Council, 1989a; Karageorgiou et al., 2000; David Walters, 2002). In fact, the most cited definitions of OSHMS in the literature review carried out include: *a set of interrelated or interacting elements to establish OSH policy and objectives, and to achieve those objectives* (ILO, 2001b:19); *a combination of the planning and review, the management organizational arrangements, the consultative arrangements and the specific program elements* (e.g. hazard identification, risk assessment and control, contractor health and safety, information and recordkeeping, and training) *that work together in an integrated way to improve health and safety performance* (Gallagher, 1997:2, 2000:1); the distinct and interconnected elements, covering all activities necessary to manage OSH, that are driven by feedback loops (Pearse, 2000, 2002); and an integrated set of organizational elements (e.g. health and safety at work policies, objectives and goals; decision-making structures and respective practices; technical resources; accountability structures and respective practices; risk assessment and risk control practices; training practices; quality assessment practices; evaluation practices; and organizational learning practices) involved in the continuous cycle of planning, implementation, evaluation and continuous improvement, to ensure the reduction of occupational risks in the workplace (Robson et al., 2005, 2007). Moreover, in their research to develop an occupational safety and health and management system assessment instrument, based on the revision of thirteen OSHMS and environmental management system models, Redinger and Levine (1998) proposed a universal OSHMS, structured around 5 organiz-

ing categories¹¹ and composed by 16 primary sections¹² and 11 secondary sections¹³. Gallagher (1997) and Gallagher et al. (2001), on the other hand, maintain that the majority of OSHMS embrace the following elements: i) in terms of organization, responsibility and accountability - involvement of top management; assignment of duties to intermediate managers and supervisors; accountability of management and performance evaluation; and organizations' safety and health at work policy; ii) at the level of consultation arrangements - workers' representatives for safety and health; conflict management system through employer and worker representatives; joint health and safety at work committees; and participation and consultation of workers; e iii) at the level of specific elements of the program - rules and procedures for safety and health; training program; inspections to workplaces; communication and investigation of incidents; declaration of principles concerning the prevention and control of occupational risks; data collection and analysis and record keeping; providing relevant information about safety and health at work; consideration of health and safety aspects in relation to procurement and design; definition of emergency procedures, first aid and health surveillance; monitoring and evaluation; and deal with specific risks and issues relating to the organization of work.

Considering the relevance of the OSHMS in the improvement of the OSH conditions in the workplaces, the research on the prevention of work-related accidents has soon been directed towards the study of the effectiveness of OSHMS in preventing accidents at work. The latter, however, has been mainly focused on five different, although interrelated, domains: i) identification of the various types of OSHMS and investigation of their differential impact on work-related accidents (Drais, Favaro, & Aubertin, 2008; Frick et al., 2000; Gallagher, 1997, 2000; Gallagher et al., 2001; Gallagher, Underhill, & Rimmer, 2003); ii) definition of OSHMS performance indicators and examination of potential correlations between the various stages of implementation of these systems and the incidence rates of accidents at work (Gallagher, 1994; Mearns, Whitaker, &

¹¹ Such 5 categories comprise: Initiation - OSH Inputs; Formulation - OSH Process; Implementation / Operations - OSH Process; Evaluation - Feedback; and Improvement / Integration - Open System Elements.

¹² The 16 primary sections are: management commitment and resources; employee participation; occupational health and safety policy; goals and objectives; performance measures; system planning and development; OSHMS manual and procedures; training system; hazard control system; preventive and corrective action system; procurement and contracting; communication system; evaluation system; continual improvement; integration; and management review.

¹³ Those 11 secondary sections include: regulatory compliance and system conformance; accountability, responsibility and authority; baseline evaluation and hazard/risk assessment; technical expertise and personnel qualifications; process design; emergency preparedness and response system; hazardous agent management system; document and record management system; auditing and self-inspection; incident investigation and root cause analysis; and medical program and surveillance.

Flin, 2003; Ramli, Watada, & Pedrycz, 2011; Redinger & Levine, 1998; Marcel Simard & Marchand, 1994); iii) investigation of potential correlation between the OSHMS constituent elements and the incidence rates of accidents at work (Barling, Kelloway, & Iverson, 2003; Blewett & Shaw, 1995; Burt, Sepie, & McFadden, 2008; Chew, 1988; Clarke & Robertson, 2005; A. Cohen, 1977; H. Cohen & Cleveland, 1983; Evans, Michael, Wiedenbeck, & Ray, 2005; Eyssen, Hoffmann, & Spengler, 1980; Forcier, Walters, Brasher, & Jones, 2001; Gallagher, 1994, 1997; Habeck, Hunt, & VanTol, 1998; Johnson, 2007; Johnstone, Quinlan, & Walters, 2005; LaMontagne, Rudd, Mangione, & Kelsey, 1996; Lilley, Feyer, Kirk, & Gander, 2002; Lippel et al., 2011; Marcus, 1988; Mearns, Flin, Gordon, & Fleming, 2001; Neal & Griffin, 2006; Nenonen, 2011; Probst & Brubaker, 2001; Quinlan et al., 2009, 2001; Ramli et al., 2011; Rebitzer, 1995; Reilly, Paci, & Holl, 1995; Shannon et al., 1996; Shaw & Blewett, 1995, 2000; M Simard & Marchand, 1995; Simonds & Shafai-Sahrai, 1977; G. S. Smith, Huang, Ho, & Chen, 2006; M. J. Smith, Cohen, Cohen, & Cleveland, 1978; Underhill & Quinlan, 2011; Varonen & Mattila, 2002; Victoria. Department of Labour, Viner Robinson Jarman Pty. Ltd, & Ballarat College of Advanced Education. Victorian Institute of Occupational Health and Safety, 1989; David Walters & Nichols, 2007; Zacharatos, Barling, & Iverson, 2005; Zohar, 1980, 2000); iv) investigation of the impact of size dimension on the OSHMS' effectiveness, in particular regarding SMEs (Arocena & Nuñez, 2010; Baldock et al., 2006; E. Cagno, Micheli, Jacinto, & Masi, 2014; Enrico Cagno, Micheli, Masi, & Jacinto, 2013; Enrico Cagno et al., 2011; Clifton, 2000; Hasle, Bager, & Granerud, 2010; Hasle et al., 2009; Hasle, Kvorning, et al., 2012; Hasle & Limborg, 2006; Hasle, Limborg, et al., 2012; Laird et al., 2011; Legg et al., 2015; Mayhew & Peterson, 1999; Micheli & Cagno, 2010; Morse et al., 2004; Okun et al., 2001; Olsen et al., 2010; Quinlan, 1999; Sørensen et al., 2007; Stevens, 1999; Targoutzidis et al., 2014; David Walters, 2006); and v) effectiveness of safety management systems in specific economic sectors of activity (Figuera & López, 2003; Hale, 2003; IAEA, 2006a, 2006b).

Regarding the various types of OSHMS, the literature tends to distinguish between two main OSHMS, considering the different motivations underlying its implementation: the mandatory the and voluntary OSHMS (Frick et al., 2000; Frick & Wren, 2000; Gallagher et al., 2001; Robson et al., 2005, 2007; Saksvik & Quinlan, 2003).

Voluntary OSHMS are the ones that are not directly linked to the fulfilment of legal requirements, although they usually consider them. They normally take the form of

standards or guidelines and are intended to provide guidance on good practices in OSH management or to define the requirements for the certification of such systems (Stolk et al., 2012). Furthermore, their adoption tends to be promoted by insurance or private consultancy companies, government agencies or organizations of standardization (Frick & Wren, 2000; Robson et al., 2007). They are usually more specific, formalized and detailed and, consequently, too complex for most of the smaller organizations (Frick & Wren, 2000; Robson et al., 2007). Common examples include, among others: the ILO-OSH:2001 guidelines on OSHMS; the British Standards Institution standards BS 8800:2004 and BS OHSAS 18001:2007; the U.S. Department of Labor Occupational Safety and Health Administration's Voluntary Protection Program; and the Portuguese Institute of Quality NP 4397:2008 standard for OSHMS requirements (Drais et al., 2008; Hasle & Zwetsloot, 2011; Palassis et al., 2006; Stolk et al., 2012; Zwetsloot, 2000).

Mandatory OSHMS, on the other hand, derived from the legislation and their application is usually enforced by Labour and/or OSH Inspectorates. They are generally simpler than the volunteers. Not only because they aim at a wider range of different organizations with different sizes, working in various sectors of activity (Robson et al., 2007), but also due to the inability of the public authorities to control the implementation of excessively detailed standards as well as their desire to avoid the imposition of excessive and disproportionate context costs (bureaucratic and administrative burdens) to economic agents (Frick & Wren, 2000). Examples of this type of systems include, besides the one established by the European Council framework Directive No. 89/391/EEC, of 12 June 1989 (European Council, 1989a), the majority of the legal regimes in force in the EU Member States for promoting OSH, such as the Portuguese legal framework for the promotion of OSH, regulated, among other legislation, by the Law No. 102/2009, of 10 September 2009 (Portuguese Parliament, 2009a).

Despite the eventual adoption of a voluntary OSHMS, all employers who pursue their activity in Portugal are obliged to comply with the national legislation related to the safety and health of their workers (Portuguese Parliament, 2009a:article 3, 2014b:article 4, paragraph 1-i).

Besides the provisions enshrined in the Constitution of the Portuguese Republic, regarding not only the worker's rights but also other rights of personal, economic and social nature (Portuguese Parliament, 1976:articles 13,16,18,24,25,27,37,43,45-47,53-55,57,59,64), they are also required to abide by a set of other legal provisions on OSH,

foreseen in the Law No. 102/2009 (Portuguese Parliament, 2009a). The latter transposes to the internal legal order the European Council framework Directive No. 89/391/EEC (European Council, 1989a) and incorporates the predictions of ILO Convention No. 155 (ILO, 1981) and the provisions of the Portuguese Labour Code (Portuguese Parliament, 2009d).

Moreover, they also must comply, when applicable, with the legal provisions of several special legal acts, as mentioned earlier: minimum OSH requirements for workplaces, commerce and services workplaces, industrial establishments, construction sites, mines and quarries and work on board fishing vessels; OSH signaling; use of machinery and work equipment; use of display screen equipment; use of personal protective equipment; exposure of workers to specific risks (e.g. noise, mechanical vibration, chemical agents, biological agents, carcinogens, mutagens, asbestos, ionizing radiation, optical radiation from artificial sources, Musculoskeletal Disorders (MSD), explosive atmospheres, use of cut-perforating medical devices, contained use of genetically modified organisms and genetically modified organisms); legal system for fire safety in buildings; and prevention of serious industrial accidents or involving dangerous substances, among others (Portuguese Government, 1958, 1965, 1996a, 1996b, 1996c, 1997a, 1997b, 2000b, 2003a, 2003b, 2005, 2006a, 1971, 2006b, 2007a, 2007b, 2008a, 2008b, 2008c, 2012a, 2013, 2015a, 2015c, 1980, 1986, 1990, 1993a, 1993b, 1993c, 1995a, Portuguese Parliament, 2009a, 2010).

When taken together, the aforementioned legal obligations and mandatory practices are not more than a true mandatory OSHMS.

Furthermore, the literature review also revealed that OSHMS, independently of their voluntary or mandatory nature, can assume various typologies, with different associated levels of effectiveness, depending on the focus of their risk control strategies ('safe person' *versus* 'safe place') and their management style ('traditional management' *versus* 'innovative management') (Gallagher, 1997; Gallagher et al., 2001); or depending on their level of integration of OSH with other management systems and practices (which could range between 'weak' and 'strong') and their occupational risks management type ('focused on procedures' *versus* 'focused on the situation') (Drais et al., 2008).

Based on the results of the research carried out on the effectiveness of different types of OSHMS, implemented in a number of companies in Australia, Gallagher (2000) concluded that there is evidence that the most effective companies in the prevention of occupational risks are the ones that implement an 'adaptive risk management system'

(complementing a control strategy based on ‘safe place’ with a ‘innovative management style’).

Drais *et al.* (2008), for their part, in the research conducted for the *Institut National de Recherche et de Sécurité* (INRS), on the implementation of OSHMS in 12 French SMEs, from various sectors of activity, concluded, through the use of factor analysis, that the effectiveness of OSHMS tends to depend more on the way they are implemented than on their own nature and that the form and the level of integration of OSH with other practices and other organization’s management systems, as well as the type of risk management adopted, determine both the effectiveness of the OSHMS and the necessary conditions for a perennial occupational risk prevention in companies.

Other critical success factors of the OSHMS’ effectiveness found on the literature review include: the involvement and commitment from top management (Gallagher *et al.*, 2001); employee’s consultation and participation (Gallagher *et al.*, 2001; Ramli *et al.*, 2011; Yorio & Wachter, 2014); assurance of adequate OSH training and information (Gallagher *et al.*, 2001; Ramli *et al.*, 2011; Yorio & Wachter, 2014); pre-and post-task safety review (Yorio & Wachter, 2014); development of safety activities (Varonen & Mattila, 2002); implementation of occupational risk assessment and control processes (Ramli *et al.*, 2011); formulation and implementation of OSH policies, strategies and programs (Ramli *et al.*, 2011); and existence of collective representation of workers in the workplaces (Arocena & Nuñez, 2010; Johnstone *et al.*, 2005; David Walters & Nichols, 2007).

Moreover, the literature review carried out also highlighted some barriers to OSH effectiveness in preventing work-related accidents, understood as predictors of OSHMS’ ineffectiveness. Those include the use of workers typically excluded from these systems and that tend to compromise their effectiveness, such as self-employed workers (European Parliament, 2014, 2015; Gallagher & Underhill, 2012; Gallagher *et al.*, 2001), casual workers (Gallagher *et al.*, 2001), temporary workers (European Parliament, 2014, 2015; Gallagher & Underhill, 2012; Gallagher *et al.*, 2001; Lippel *et al.*, 2011; Underhill & Quinlan, 2011) and part-time workers (Gallagher *et al.*, 2001). They also comprise the use of subcontracted companies (European Parliament, 2014, 2015; Gallagher & Underhill, 2012; Gallagher *et al.*, 2001; Nenonen, 2011; Quinlan *et al.*, 2009, 2001; Rebitzer, 1995) and, most especially, the use of outsourced (external) OSH services to the detriment of in-house (internal) services (COWI, 2015). It is worth noting, in this respect, that the Portuguese legislator has chosen to establish in the legal

framework for the promotion of OSH, as a general rule, the mandatory adoption by the employers of the internal safety and health services, while allowing some exceptions, subject to verification of certain conditions (namely the incidence rates of work-related accidents and occupational diseases, the nature of the risks to which their workers are exposed, etc.) upon request to ACT, to be granted only if the requirements for derogation of such general rule are met (Portuguese Parliament, 2009a:article 74, paragraph 2).

Other common barriers to OSH effectiveness in the prevention of accidents at work involve: inadequate customization of the OSHMS to the specific needs of the organization (Champoux & Brun, 2003; Gallagher et al., 2001; Legg et al., 2015; Micheli & Cagno, 2010); lack of access by workers to relevant information (Gallagher et al., 2001; Hasle, Limborg, et al., 2012; Olsen et al., 2010); insufficient or inadequate training provided to workers and managers (Bellamy & Geyer, 1992; Bird, 1974; Dwyer, 1991; Gallagher et al., 2001; Hasle, Limborg, et al., 2012; Legg et al., 2015; Nunes, 2010; Olsen et al., 2010; Spangenberg et al., 2003; Stave & Törner, 2007); lack of worker's consultation and involvement (Gallagher et al., 2001; Hasle, Limborg, et al., 2012; Olsen et al., 2010); the exposure of workers to high levels of occupational risks (Kirschenbaum, Oigenblick, & Goldberg, 2000; Rommel et al., 2016), to manual handling of heavy loads, to work with inadequate postures and to work under pressure (Rommel et al., 2016) or exposed to dangerous substances or situations (Clifton, 2000; Micheli & Cagno, 2010; Sørensen et al., 2007; Targoutzidis et al., 2014); and the worker's exposure to working conditions characterized by an excessive number of working hours, lack of rest and consequent fatigue and stress (Lilley et al., 2002; Rommel et al., 2016; Stave & Törner, 2007).

2.7 Role of the labour inspection in promoting OSH and preventing work-related accidents

Within the above mentioned OSH international and national legal framework, the labour inspection plays a key role in ensuring that rights at work are turned into reality, ensuring that laws are respected and that actors know their rights and obligations, thus protecting employees' rights, ensuring health and safety at the workplaces, combating unsafe working environments and, therefore, preventing the occurrence of accidents at work (European Parliament, 2014).

Moreover, and despite the relevance widely acknowledged to such international and national OSH regulations, it seems reasonable to assume that without proper enforcement compliance would be compromised (Anderson, 2007; ILO, 2007; Jensen, 2004; Niskanen et al., 2014; Richthofen, 2002), with the foreseeable consequences in terms of the increase in the work-related accidents (Frick, 2011).

According to the ILO (2007), the labour inspection constitutes an indispensable component of a national OSH system, playing an important role in the application of standards, policies, systems and programs, either confirming that action on the ground is taking place as foreseen, identifying shortfalls and means of resolving any problems or using sanctions to enforce correct implementation.

In this respect, Richthofen (2002) argues that labour inspection could also play an additional role, going a little bit further from its traditional approach (of visiting, monitoring, enforcing, advising and inquiring), both through the design and implementation of policies and procedures aimed at promoting the cooperation with and between other social actors (e.g. representative associations of employers and workers, professional, trade and industrial associations, insurance companies) and through the development and promotion of the concepts of costs and benefits associated with the promotion of safer and healthier workplaces, to convince employers' top managers that 'safety pays' and that 'good health is good for business'.

In this context, labour inspection assumes a paramount importance within the international and European legal architecture for promoting OSH, notably through the labour inspection international standards set by the ILO Conventions No. 81, concerning labour inspection in industry and commerce (ILO, 1947), and No. 129, relating to labour inspection in agriculture (ILO, 1969), which are mainly focused on the definition of the labour inspection system that should be implemented in the ILO Constituents.

In addition to place labour inspection under the supervision and control of a central authority, they both define the main functions of labour inspection system (e.g. enforce the legal provisions related to work conditions and the protection of workers, supply technical information and advice to employers and workers and bring to the attention of competent authorities any defects or abuses not covered by existing legal provisions). They also outline the powers of labour inspectors (e.g., to enter freely and without previous notice at any hour of the day or night in any workplace; to carry out any examination, test or enquiry which may be considered necessary; to take steps with a view to remedying defects observed at workplaces; to require alterations to workplaces, to be

carried out immediately or within a specified time frame; and to take immediate measures, with executory force, in the event of imminent danger to the health or safety of the workers), understood as essential to the accomplishment of its primary functions of preventing workplace hazards (ILO, 2006c). Moreover, they foresee legal provisions regarding the mandatory notification to labour inspectorate of work-related accidents and occupational diseases and the liability for prompt legal proceedings without previous warning and for application of adequate penalties to any person who violate or neglect to observe legal provisions enforceable by labour inspectors or for obstructing labour inspectors in the performance of their duties. Furthermore, they impose to labour inspectors the duty of professional secrecy and a particularly demanding incompatibilities regime. Finally, they address the importance of the labour inspectors being public servants, independent from changes of government and of improper external influences, recruited solely on the basis of their qualifications and provided with the necessary resources (e.g. financial, facilities, equipment, means of transportations), as well as the need to ensure that labour inspectorates are provided with the adequate number of labour inspectors (ILO, 1947, 1969, 2006b).

2.8 Labour inspectorates' performance assessment

Performance evaluation systems have long been used in business, especially since the 1950s, following the pioneering work developed by Peter Drucker, within the so-called neoclassical theory of management, namely in the field of the management by objectives (Drucker, 1954).

In the field of OSH, however, particularly in what concerns the labour inspectorates' performance assessment, and despite the recognized relevance of their performance measurement, the literature tends to focus mainly on the employers' OSH performance assessment as well as on the investigation of the respective and most suitable OSH performance indicators (Blair & O'Toole, 2010; Haas & Yorrio, 2016; Mearns et al., 2003; Podgórski, 2015; Robson et al., 2007; Shaw, 2002; Shea, De Cieri, Donohue, Cooper, & Sheehan, 2016; Sheehan, Donohue, Shea, Cooper, & Cieri, 2016; Sinelnikov, Inouye, & Kerper, 2015), rather than on the research targeting specifically the labour inspectorates' performance assessment (Adalberto & Telma, 2005; Geminiani & Smallwood, 2013; Niskanen et al., 2014; Tösine & Wedege, 2013; Vasconcelos, 2014).

Several explanations for the relative literature scarcity on labour inspectorates' performance assessment have been put forward: the absence of a quantitative technique specifically designed for the performance assessment of labour inspectorates which, moreover, has already justified a call of both the IALI and the ILO, for the development of performance-measuring tools to assess labour inspectorates' performance (ILO, 2006c; Tösine & Wedege, 2013); its complexity, when compared to what usually happens in business, considering the increased difficulties to define what should be measured and how, as well as regarding the imputation of OSH improvements to the labour inspectorates; the difficulties associated to data collection, not only because sometimes it is not available, but also because it is often protected by legislation concerning the protection of personal data; the usual time lag between the implementation of the measures and their results; and the costs of the development and implementation of these performance measurement systems, which are typically high and, not rarely, prohibitive for the labour inspectorates (Tösine & Wedege, 2013).

In the light of the above, the most frequently used methods for evaluating the performance of the labour inspectorates are the ILO labour inspection audit methodology (ILO, 2006c, 2009a, 2009b, 2011b) and the Senior Labour Inspectors Committee (SLIC) evaluation methodology (SLIC, 2007, 2015a, 2015b, 2016), which are essentially qualitative in nature. The use of well-known performance measurement tools to assess labour inspectorates' performance, such as the Dashboards and the Balance Scorecard, has also been reported (Tösine & Wedege, 2013). Other less structured methodologies have also been applied. Either based on the analysis of quantitative and qualitative data regarding the effects of the inspection in the workplaces, mainly collected through questionnaires filled by representatives of the inspected employers and by other persons involved in the inspections carried out (Geminiani & Smallwood, 2013; Niskanen et al., 2014), or through the comparison of the labour inspectorate data on its costs, resources consumed and outputs, and its presumed outcomes, namely in terms of detected compliance and non-compliance rates and figures (Adalberto & Telma, 2005).

It is also worth mentioning, although not being exactly a methodology for evaluating the performance of labour inspectorates, the conceptual framework proposed by the IALI's Handbook for Labour Inspectorates (Tösine & Wedege, 2013), which provides labour inspectorates with a practical guidance on how to measure their performance.

2.9 Research gaps

Notwithstanding the diversity and quality of the literature reviewed within the scope of this study, it is important to highlight, however, some important gaps found on the field of work-related accidents prevention effectiveness.

Concerning the causes and predictors of work-related accidents in Portugal, it was possible to identify only 7 research studies focused in the causes and predictors of work-related accidents in Portugal. From these studies, only 4 were published in scientific journals with peer review (Antão, Almeida, Jacinto, & Soares, 2008; Jacinto, Canoa, & Soares, 2009; Marques, Jesus, Olea, Vairinhos, & Jacinto, 2014; Silva & Jacinto, 2012). The remaining 3 concerns 2 master dissertations (Graça, 2014; Prazeres, 2012) and a book about the determinants of occupational accidents (Jacinto et al., 2007). None was exclusively focused on predictors of fatal work-related accidents in Portugal. Moreover, to the best of our knowledge, no study, book or scientific article, not exclusively focused on the determinants of work-related accidents in a given sector of activity or specific type of company, has been published.

Furthermore, and in addition to the gaps commonly recognized to the international research on OSHMS effectiveness in preventing occupational accidents, particularly in view of their small number, methodological limitations and mixed and inconclusive results (Eisner & Leger, 1988; Frick et al., 2000; Gallagher & Underhill, 2012; Gallagher et al., 2001; Guastello, 1991; Robson et al., 2007; Stolk et al., 2012), it was found no empirical study, journal article or report on the effectiveness of OSHMS in the prevention of (fatal or non-fatal) work-related accidents in Portugal.

Moreover, and to the best of our knowledge, there are no published studies on the use of DEA to evaluate the performance of labour inspectorates, nor it was found any study or publication on labour inspectorates' performance assesement, aimed at assessing quantitatively the efficiency and effectiveness of labour inspectorates, through a single composite measure and accounting for the simultaneous use of multiple input, output and outcome indicators with endogenous choice of weights. Indeed, and besides the IALI's Handbook for Labour Inspectorates (Tösine & Wedege, 2013), which provides some practical guidance on how they should measure their performance, the literature focus alomost exclusively on the employers' OSH performance evaluation and on OSH performance indicators.

In this context, it is expected that this research can make a relevant contribution on such under-researched field as the work-related accidents prevention effectiveness in Portugal.

Chapter 3 - Contributions to the improvement of fatal work-related accidents prevention effectiveness in Portugal: predictors and occurrence probabilities

Chapter 3 - Contributions to the improvement of fatal work-related accidents' prevention effectiveness in Portugal: predictors and occurrence probabilities¹⁴

Summary

The ACT as well as other national authorities and actors within the national system for prevention of occupational risks are expected to improve both the efficiency and the effectiveness of their performance, namely in preventing the occurrence of fatal work-related accidents in Portugal.

The purpose of the research on this topic is precisely to identify the significant predictors of fatal work-related accidents in Portugal, and then estimate their occurrence probabilities.

A sample of 1,160 work accidents (953 non-fatal and 207 fatal) that occurred in continental Portugal, between 1 January 2013 and 22 October 2015, subjected to ACT work accident inquiry, has been used.

The results of the estimated logistic regression model show that neither sex nor the employer's economic activity sector have a statistically significant effect on fatal work-related accidents occurrence probability in Portugal. It also revealed that the type of workplace, deviation and injury, as well as the employer's size, the worker's age and the worker's employment status are indeed the significant predictors of fatal work-related accidents occurrence in Portugal.

These findings are of paramount importance to guide the key stakeholders' effort. The scarce resources should be concentrated where the effect is more significant: elder employees with permanent employment contracts who work in trade/services or industrial workplaces of larger employers, exposed to deviation by overflow, overturn, leak, flow, vaporization and emission, which can cause MSD, wounds, fractures or amputations.

¹⁴ A shorter version of the research on this topic is currently pending review, following its submission for publication, in September 1st, 2016, to the *International Labour Review*, an ILO journal on labour market institutions and economics, with peer review, indexed by Scopus (SJR Quartile: Q2; SJR: 0.445; IF: 0.812). It has been also selected for oral presentation at the VIII Postgraduate Conference 2017 on Management, Hospitality and Tourism, to be held in the School of Management, Hospitality and Tourism of the University of Algarve, in July 7th, 2017. The latter is also pending review, following its submission, in February 3rd, 2017, for presentation at the 14th International Conference on Urban Health (ICUH) 2017, organized by Elsevier, to be held in Coimbra, Portugal, in 26-29 September 2017. In addition, it is also pending review, following its submission, in February 3rd, 2017, for presentation at the II Congresso Luso-Brasileiro de Segurança, Saúde Ocupacional e Ambiental (SsOA) 2017, to be held in Rio de Janeiro, Brasil, in 6-7 July 2017.

3.1 Introduction

Over the last decades there has been developed a considerable amount of research about the causes and predictors of work-related accidents.

Notwithstanding the diversity and quantity of such research, it was possible to identify only 7 research studies, of which only 4 were published in scientific journals with peer review: identification of the main causes of accidents at work in the fisheries sector (Antão et al., 2008); analysis of the factors (workplace and organizational) that cause accidents at work in the food industry, through the use of WAIT (Work Accidents Investigation Technique) (Jacinto et al., 2009); effect of alcohol and drugs testing on the risk of accidents at work (Marques et al., 2014); and definition of work accidents-type in extractive industry, based on a multivariate analysis of the respective causes through data mining (Silva & Jacinto, 2012). The remaining 3 researches on the causes and determinants of work-related accidents in Portugal concerns 2 master dissertations on work-related accidents in the extractive industry (Graça, 2014; Prazeres, 2012) and a book about the determinants of occupational accidents in the Portuguese economic sectors with higher employment density and higher incidence rates of accidents at work (Jacinto et al., 2007). It was found no study or scientific article reviewed by peers who focus exclusively on the predictors of fatal work-related accidents in Portugal, or that was not exclusively focused on the determinants of work-related accidents in a given sector of activity or specific type of company.

In this context, it is expected that the research on this topic may contribute to fill the gap of scientific research in Portugal, in this relevant and specific field of the predictors of fatal work-related accidents.

Its relevance results from the understanding that the most serious work-related accidents are the fatal ones and that causality patterns between fatal and non-fatal work-related accidents are different, thus implying that different prevention strategies should be applied in order to ensure their effectiveness, as argued by Hale (2001) and noted by Jacinto et al. (2007), in contrast with Heinrich (1931) and Bird & Germain (1966), who believed that ‘acting on a common ground’, at the bottom of the ‘pyramid of accidents’, would prevent accidents from happening at the top.

The main goal of the research on this topic consists, therefore, in the identification of the (few) variables that (better) explain and predict the occurrence of fatal work-related

accidents in Portugal and that (more) contribute (positively or negatively) to the probability of their occurrence.

The identification of those variables, as well as the sign and the degree of their association with the occurrence of this type of work-related accidents, is hereby understood, by reference to Ohmae (1982), as the true ‘critical success factors’ for the Portuguese authorities to tackle the occurrence of fatal work-related accidents in Portugal.

Indeed, and given the scarce nature of the resources available to the Portuguese authorities, those resources should be judiciously concentrated to ensure the efficiency and effectiveness of such fight.

With these objectives in mind, the research on this topic starts with a literature review on the causes and predictors of work-related accidents and the definition of the research hypotheses. Methodological issues (e.g., data, population and sample; variables to be considered; and logistic regression model specification) are then dealt with. The following section is dedicated to the presentation and discussion of results. The subsequent sections include the research concluding remarks and the identification of their main policy implications. The main limitations of this research are addressed in the following section. Finally, the research finishes sharing some thoughts on possible paths and perspectives for further research.

3.2 Literature review and research hypotheses

The research that has been developed, over the last eight decades, on the causes and circumstances of work-related accidents, has given relevant contributions for deepening the knowledge about work-related accidents.

Whether based in a sequential and causal determinism approach (Bird, 1974; Bird & Germain, 1966, 1986; Heinrich, 1931; Heinrich et al., 1980) or, more recently, in a more systemic, contingent, epidemiological or socio-technical perspective (Adams & Thompson, 2002; Bellamy & Geyer, 1992; Cardella, 1999; Cordeiro et al., 2005; Dias, Cordeiro, & Gonçalves, 2006; Dwyer, 1991; Goguelin, 1996; Hale, 2001; Monteau & Favaro, 1990; Nunes, 2010; O’Connor & O’Connor, 2005, 2006; Perrow, 1999; Reason, 1997; Roxo, 2004; Turner & Pidgeon, 1997).

More recently, the research is also focusing on the identification of more comprehensive variables of personal, socio-economic, organizational and situational nature. These predictor variables allow a broader understanding of work-related accidents determi-

nants and the estimation of their occurrence probabilities. They provide a far-reaching insight that enable the upstream adoption of more effective and efficient policies and measures, intended to minimize their probabilities of occurrence, as well as the severity of its effects, thus contributing to the improvement of OSH conditions at the workplaces (Jacinto et al., 2007; Nunes, 2010; Roxo, 2004).

For example, Kirschenbaum et al. (2000) and Santana et al. (2003) research results suggest that sex is not a predictor variable of work-related accidents occurrence. However, the results of the researches carried out more recently by Cordeiro et al. (2005), Zangirolani et al. (2008) and Rommel et al. (2016) indicate that male workers have a significantly higher probability of being victims of work-related accidents. Zangirolani et al. (2008) attribute that greater propensity to the higher concentration of occupational risks in occupations performed mostly by men. In the light of these precedent research results, the following research hypothesis is defined: **H1 - Male workers, *ceteris paribus*, have higher probability of being victims of fatal work-related accidents.**

Worker's age is also a variable whose correlation with work-related accidents number or incidence rates is commonly tested. Kirschenbaum et al. (2000) observed that age was not a predictor of work-related accidents, whereas Rommel et al. (2016), more recently, identified the existence of a statistically significant positive correlation between age and the number of work-related accidents. Those findings allow inferring the following hypothesis: **H2 - The probability of a worker being victim of a fatal work-related accident is positively correlated, *ceteris paribus*, with his age.**

Moreover, it is usual to assign a higher probability of being victim of a work-related accident to workers of the economic activity sectors that have greater absolute or relative frequency of work-related accidents or higher incidence rates. This is the case of both the successive Portuguese National Strategies for the Promotion of Occupational Safety and Health (PNSPOSH) (Portuguese Government, 2008d, 2015e) and the Jacinto et al. (2007) research. According to the latter, workers most likely to be victims of fatal work-related accidents are those working in mining and quarrying. The aforementioned PNSPOSH, on the other hand, provides that prevention should be aimed at the economic activity sectors which have been presenting the highest work-related accidents absolute frequency, such as manufacturing, construction, wholesale and retail trade, accommodation, catering and similar, administrative activities and support services, and human health activities and social support (Portuguese Government, 2008d, 2015e). These evidences support the following research hypothesis: **H3 - Workers of economic activ-**

ity sectors such as construction, agriculture, forestry and fishing, manufacturing, transport and storage, and wholesale and retail trade have, *ceteris paribus*, a greater propensity to be victims of fatal work-related accidents.

In addition to the economic activity sector of the employer, the current trend towards more flexible labour relations, observed by Quinlan & Mayhew (2000), seems to suggest that the type of workplace should also be taken into account, although Jacinto et al. (2007) considers that the type of workplace (being understood as subsumed in the employer's activity sector) is not, by itself, a relevant determinant of a work-related accident. Conversely, in the face of the growing use of subcontractors, temporary workers, independent workers and so on, the fact that the work-related accidents are recorded in the activity sector of the victims' employer rather than in the activities' beneficiary economic sector, is inducing the need for the additional consideration of the nature of the workplace. This circumstance has already justified the inclusion of the variable 'working environment' (with categories such as 'industrial site', 'construction site, construction, opencast quarry, opencast mine', 'tertiary activity area, office, amusement area', etc.) in the ESAW Classification Methodology (ESAWCM) (Eurostat, 2001). The previous concerns led to the placement of the following research hypothesis: **H4 - The type of workplace influences the probability of occurrence of a fatal work-related accident.**

Other frequent predictor of work-related accidents arises from the relevance that several researchers have been giving to the employer's size factor (either in terms of number of employees or business turnover) to the occurrence of work-related accidents (Legg et al., 2015; Micheli & Cagno, 2010; Sørensen et al., 2007). For instance, in a research on the impact of OSH practices on the incidence rates of work-related accidents, Yorio & Wachter (2014) found that despite the steadily influence of OSH practices on the reduction of the propensity for the occurrence of work-related accidents across major industrial sector types, its impact varies considerably according to the size of establishments. Micheli & Cagno (2010) and Sørensen et al. (2007), for example, maintain that the employer's size has a decisive influence in OSH management at the workplaces and, consequently, in the occurrence of work-related accidents, especially in what concerns SMEs. Despite the underreporting of work-related accidents occurrences by SMEs, noted by several researchers (Legg et al., 2015; Morse et al., 2004; Sørensen et al., 2007; Stevens, 1999), most of them argue that the propensity for the workers of smaller employers to be victims of work-related accidents is higher than the one of the

workers of larger employers, due to the specific characteristics of SMEs. In their opinion, these SMEs characteristics tend to create real barriers to the implementation and maintenance of safe and healthy working environments, leading to an increased propensity for the occurrence of work-related accidents (Baldock et al., 2006; Enrico Cagno et al., 2011; Gallagher et al., 2001; Hasle et al., 2009; Hasle, Kvorning, et al., 2012; Hasle & Limborg, 2006; Laird et al., 2011; Mayhew & Peterson, 1999; Morse et al., 2004; Okun et al., 2001; Sørensen et al., 2007; Stevens, 1999; Targoutzidis et al., 2014; David Walters, 2006). Besides the introduction of the variable ‘size of the enterprise’ (in terms of the number of workers) in the ESAWCM (Eurostat, 2001), this assumption has also determined the focus of the successive PNSPOSH on the implementation and follow-up of OSH systems in micro enterprises and SMEs (Portuguese Government, 2008d, 2015e). The results of the aforementioned researches, regarding the employer’s size factor, support, therefore, the following research hypothesis: **H5 - Micro enterprises and SMEs workers have, *ceteris paribus*, higher probability of having fatal work-related accidents.**

Furthermore, and despite the lack of consensus, the research has also been focused on work-related accidents predictors such as the worker’s employment status. Santana et al. (2003), for example, concluded that there were no statistically significant differences in the incidence rates of non-fatal work-related accidents between types of employment contracts, while Probst & Brubaker (2001) highlighted the relevance of job security and Zangirolani et al. (2008) concluded that the self-employed have a lower exposure to the risk of suffering accidents, due to greater flexibility in their routine and in the performance of their duties. This last conclusion, however, contrasts with other research results which support that more flexible labour relations (such as self-employment, as well as the use of outsourcing and casual, temporary and part-time workers) increase the propensity for the occurrence of work-related accidents (Gallagher & Underhill, 2012; Gallagher et al., 2001; Lippel et al., 2011; Underhill & Quinlan, 2011). Building on such mixed results, the following hypothesis is placed: **H6 - *Ceteris paribus*, the more precarious is the worker’s employment status, the greater is its likelihood of being victim of a fatal work-related accident.**

Other common situational work-related accidents predictors comprise variables such as the ‘type of deviation’ leading to the accident and the ‘type of injury’ produced by the accident, as used by Jacinto et al. (2007), with reference to the ESAWCM (Eurostat, 2001). Regarding the ‘deviation’ variable, Jacinto et al. (2007) found that the deviation

‘body movement under or with physical stress’ is not a predictor of fatal work-related accidents. Despite the large variability observed among economic activity sectors, they also found that the main explanatory deviations leading to fatal work-related accidents were the ‘loss of control’ and the ‘fall of persons’ (Jacinto et al., 2007). The above mentioned findings support the following research hypothesis: **H7 - The loss of control and falls are the two types of deviations that more likely give rise to fatal work-related accidents.**

Jacinto et al. (2007) research also indicates, in relation to the ‘type of injury’ variable, that when the type of injury produced is known, the great variability between sectors of activity hinder the identification of the categories of the variable ‘type of injury’ that better explain fatal work-related accidents. It should be noted, however, that in the majority of the work-related accidents studied by Jacinto et al. (2007), and regardless the concerned activity sector, the most frequent category of the categorical variable ‘type of injury’ was the ‘unknown injury’ - code ‘000’ of the ESAWCM (Eurostat, 2001). Nevertheless, according to the ESAW, the most frequent ‘type of injury’ in the case of fatal work-related accidents recorded in Portugal in 2013 was ‘concussions and internal injuries’, observed in 77 (around 48%) of the 160 fatal work-related accidents victims reported in that year (Eurostat, 2016). This evidence supports the following research hypothesis: **H8 - The types of injuries more likely to cause fatal work-related accidents are, *ceteris paribus*, the concussions and internal injuries.**

3.3 Methodology

3.3.1 Data, population and sample

The population to study in the scope of this research topic consists of the fatal and non-fatal work-related accidents occurred in the continental territory of Portugal, within which the ACT has legal jurisdiction (Portuguese Government, 2012c), between 1 January 2013 and 22 October 2015.

The convenience sample used (cf. Appendix 1) consists of 1,160 work-related accidents occurred in continental Portugal between 1 January 2013 and 22 October 2015 (irrespectively of the resulting number of days of absence from work), subject to valid work-related accident inquiry performed by ACT and completed within the same time period. The sample is composed by 953 non-fatal work-related accidents and 207 fatal

work-related accidents (corresponding to about 82% and 18%, respectively, of the total number of work-related accidents in the sample).

It is not possible to assess the representativeness level of the sample used, however, due to the lack of official data on accidents at work occurring in Portugal in the year 2015. The most recent official statistics on work-related accidents in Portugal were published in October of 2016 and refer to the work-related accidents occurred in 2014 (Eurostat, 2016; GEP, 2016).

3.3.2 Variables considered

Taking into consideration the available data, the research objectives, the literature review carried out and the resulting research hypotheses to be tested, the variables considered are those listed in Table 3.

3.3.3 Data analysis method

The data analysis method adopted in the research on this topic is the logistic regression. This is a method that has been used in a number of studies on work-related accidents (Cordeiro et al., 2005; Dias et al., 2006; Fehlberg, Santos, & Tomasi, 2001; Kirschenbaum et al., 2000; Lima et al., 1999; Rommel et al., 2016), as well as in other areas of knowledge (Lee, 2005; Oom do Valle, Correia, & Rebelo, 2008; Pearce & Ferrier, 2000; A. M. dos Santos, Seixas, Pereira, & Medronho, 2005), when the dependent variable is categorical binary, regardless of the qualitative or quantitative nature of the independent variables. It is a model especially suitable and useful for modelling the occurrence of one of the two possible realizations of the dependent variable (in this case, the fatal nature of the occupational accident) in probabilistic terms, allowing the evaluation, for each of the variables included in the model, of its explanatory power, level of significance, sign of influence (positive or negative) and measure of impact, *ceteris paribus*, in the *logit*, therefore in the *odds ratio* and, consequently, in the probability of success of the dependent variable (Andrews, Klem, Davidson, O'Malley, & Rodgers, 1981; Ferreira, 2013; Marôco, 2014). Taking into account the nature of the dependent variable, the Maximum Likelihood method must be adopted for the estimation of the model parameters. The data analysis was carried out with the use of the *IBM SPSS* software, version 21.

VARIABLE				
No	NAME	DESCRIPTION	TYPE	VALUES
DEPENDENT VARIABLE				
1	ACCID	Nature of the work-related accident.	Categorical binary	Assumes the value 1 when the accident at work caused a fatality (fatal work-related accident); and 0 otherwise.
INDEPENDENT VARIABLES				
2	SEX	Worker's sex.	Dummy	Assumes the value 1 when the worker is male; and 0 when the worker is female.
3	AGE	Worker's age.	Quantitative	Number of years old.
4	EMPSTAT	Worker's type of employment status. For the purpose of analysis, this variable was recoded through the following 3 dummy variables (see below): PERM (indefinite period employment contract or permanent contract); FIXTERM (fixed-term employment contract); and TEMP (temporary work contract). The variable OTHEMPSTAT (other employment status), was considered the reference category . As such, it was not included in the model.	Qualitative variable with 4 categories	Permanent contract; fixed-term contract; temporary work contract; and other employment status.
4.1	PERM	Indefinite period employment contract or permanent contract.	Dummy	Assumes the value 1 if the worker is linked to the employer by an employment contract for an indefinite period; and 0 otherwise.
4.2	FIXTERM	Fixed-term employment contract.	Dummy	Assumes the value 1 if the worker is linked to the employer through a fixed-term employment contract; and 0 otherwise.
4.3	TEMP	Temporary work contract.	Dummy	Assumes the value 1 if the worker is linked to the employer (as user) on the basis of a temporary employment contract; and 0 otherwise.
4.4	OTHEMPSTAT	Other employment status (e.g. managing partner, service commission, internship, undeclared worker or self-employed).	Dummy - reference category	Assumes the value 1 if the worker is linked to the employer by other employment status; and 0 otherwise.
5	SIZE	Employer's size (in terms of the number of workers). For the purpose of analysis, this variable was recoded through the following 2 dummy variables: SME (SME employer); and LARGE (large employer). The variable MICRO (micro employer), was considered the reference category . As such, it was not included in the model.	Qualitative variable with 3 categories	Micro employer; SME employer; and Large employer.
5.1	SME	SME employer (with at least 10 and less than 250 workers).	Dummy	Assumes the value 1 when the employer is an SME; and 0 otherwise.
5.2	LARGE	Large employer (with at least 250 workers).	Dummy	Assumes the value 1 when the employer is a large employer; and 0 otherwise.
5.3	MICRO	Micro employer (with less than 10 workers).	Dummy - reference category	Assumes the value 1 when the employer is a Micro employer; and 0 otherwise.
6	PEACSC	Portuguese Economic Activities Classification Section Code (PEACSC) of the employer. For the purpose of analysis, this variable was recoded through the following 2 dummy variables: MANUF (manufacturing) and TRADE (wholesale and retail trade). The variable OTHPEACSC (Other PEACSC) was considered the reference category . As such, it was not included in the model.	Qualitative variable, with 3 categories	Manufacturing; Wholesale and retail trade; and Other economic activity sectors.
6.1	MANUF	Employer belonging to the manufacturing economic activity sector (i.e., to the section 'C' of the PEACSC).	Dummy	Assumes the value 1 when the employer belongs to the manufacturing economic activity sector; and 0 otherwise.
6.2	TRADE	Employer belonging to the wholesale and retail trade economic activity sector (i.e., to the section 'G' of the PEACSC).	Dummy	Assumes the value 1 when the employer belongs to the wholesale and retail trade economic activity sector; and 0 otherwise.
6.3	OTHPEACSC	Employer belonging to another economic activity sector than the manufacturing or the wholesale and retail trade (i.e., which belongs to other sections of the PEACSC than 'C' or 'G').	Dummy - reference	Assumes the value 1 when the employer belongs to another economic activity sector than the manufacturing or the wholesale and retail

VARIABLE				
No	NAME	DESCRIPTION	TYPE	VALUES
7	WRKPLC	Type of workplace where the work-related accident occurred. For the purpose of analysis, this variable was recoded through the following 2 dummy variables: INDAR (industrial area) and TRDSRVAR (trade or services area). The variable OTHWRKPLC (Other types of workplaces), being considered as the reference category, was not included in the model.	category Qualitative variable, with 3 categories	trade; and 0 otherwise. Industrial area; Trade or services area; and Other types of workplaces.
7.1	INDAR	Industrial area (area classified as 'industrial site', with reference to the category code '010' for the ESAW (Eurostat, 2001) 'working environment' variable.	Dummy	Assumes the value 1 when the work-related accident occurred in an industrial area; and 0 otherwise.
7.2	TRDSRVAR	Trade or services area (i.e., area classified as 'tertiary activity area, office or amusement area', with reference to the category code '040' of the ESAW (Eurostat, 2001) 'working environment' variable.	Dummy	Assumes the value 1 when the work-related accident occurred in a trade or services area; and 0 otherwise.
7.3	OTHWRKPLC	Other type of workplace (i.e., other type of workplace than industrial area or trade or services area).	Dummy - reference category	Assumes the value 1 when the work-related accident occurred in other type of workplace; and 0 otherwise.
8	DEVIAT	Type of deviation that caused the work-related accident. For the purpose of analysis, this variable was recoded through the OVEDEV dummy variable (deviation by overflow, overturn, leak, flow, vaporization or emission), which corresponds to the category code '010' for the ESAW 'Deviation' variable (Eurostat, 2001). The variable OTHDEV (Other type of deviation) was considered the reference category . As such, it was not included in the model.	Qualitative variable with 10 categories	Assumes the 10 generic categories codes (00, 10, 20, 30, 40, 50, 60, 70, 80 and 99) foreseen in the Eurostat ESAW (Eurostat, 2001).
8.1	OVEDEV	Deviation by overflow, overturn, leak, flow, vaporization or emission (i.e., when the deviation leading to the work-related accident has the category code '20' of the ESAW (Eurostat, 2001) 'Deviation' variable).	Dummy	Assumes the value 1 when the accident at work occurred due to a 'deviation by overflow, overturn, leak, flow, vaporization or emission'; and 0 otherwise.
8.2	OTHDEV	Other type of deviation (when the deviation leading to the work-related accident is other than overflow, overturn, leak, flow, vaporization or emission).	Dummy - reference category	Assumes the value 1 when the accident at work occurred due to other deviation than overflow, overturn, leak, flow, vaporization or emission'; and 0 otherwise.
9	INJURY	Type of injury produced by the work-related accident. For the purpose of analysis, this variable was recoded through the following 2 dummy variables: MSDWO (musculoskeletal disorders or wounds) and FRACAMP (fractures or amputations). The variable OTHINJ (other type of injuries) was considered the reference category . As such, it was not included in the model.	Qualitative variable with 3 categories	MSD or wounds; Fractures or amputations; and Other type of injuries.
9.1	MSDWO	Musculoskeletal disorders or wounds (i.e., when the accident at work caused injuries classified with category codes 030 - Dislocations, sprains and strains or 010 - Wounds and superficial injuries, of the ESAW (Eurostat, 2001) 'Type of injury' variable).	Dummy	Assumes the value 1 when the accident at work caused injuries classified with the ESAW (Eurostat, 2001) category codes 010 or 030, for the 'Type of injury' variable; and 0 otherwise.
9.2	FRACAMP	Fractures or amputations (i.e., when the accident at work produced injuries classified with the category codes 020 - Bone fractures or 040 - Traumatic amputations - loss of body parts, of the ESAW (Eurostat, 2001) 'Type of injury' variable).	Dummy	Assumes the value 1 when the accident at work caused injuries classified with the ESAW (Eurostat, 2001) category codes 020 or 040, for the 'Type of injury' variable; and 0 otherwise.
9.3	OTHINJ	Other type of injuries (i.e., when the accident at work caused other injuries than the ones classified with category codes 010, 020, 030 or 040, of the ESAW (Eurostat, 2001) 'Type of injury' variable).	Dummy - reference category	Assumes the value 1 when the accident at work caused injuries classified with other ESAW (Eurostat, 2001) category codes than 010, 020, 030 or 040, for the 'Type of injury' variable; and 0 otherwise.
10	AGE*SEX	Interaction term between AGE and SEX variables.	Quantitative	Product between AGE and SEX variables.

Table 3- Dependent and independent variables considered

Source: Own elaboration.

3.4 Presentation and discussion of the results

Logistic regression model to estimate:

$$\ln\left(\frac{P_i}{1-P_i}\right) = \hat{\beta}_0 + \hat{\beta}_1(INDAR) + \hat{\beta}_2(TRDSRVAR) + \hat{\beta}_3(OVEDEV) + \hat{\beta}_4(MSDWO) \\ + \hat{\beta}_5(FRACAMP) + \hat{\beta}_6(MANUF) + \hat{\beta}_7(TRADE) + \hat{\beta}_8(SME) \\ + \hat{\beta}_9(LARGE) + \hat{\beta}_{10}(AGE) + \hat{\beta}_{11}(SEX) + \hat{\beta}_{12}(PERM) \\ + \hat{\beta}_{13}(FIXTERM) + \hat{\beta}_{14}(TEMP) + \hat{\beta}_{15}(AGE * SEX) + \hat{\mu}_i \quad (1)$$

The estimation results are shown in Table 4.

Independent variables & constant	$\hat{\beta}$	S.E.	Wald	df	p-value	$e^{\hat{\beta}}$
Constant	-15.090	1.772	72.492	1	0.000	0.000
FRACAMP	3.332	0.313	113.163	1	0.000	27.987
MSDWO	3.427	0.595	33.173	1	0.000	30.771
AGE	0.026	0.009	8.928	1	0.003	1.026
PERM	0.977	0.373	6.862	1	0.009	2.655
OVEDEV	1.535	0.636	5.817	1	0.016	4.642
TRDSRVAR	2.326	1.055	4.858	1	0.028	10.233
INDAR	0.511	0.256	3.986	1	0.046	1.667
LARGE	0.550	0.327	2.826	1	0.093	1.734
TEMP	1.026	0.726	1.998	1	0.158	2.790
FIXTERM	0.557	0.404	1.906	1	0.167	1.746
MANUF	0.319	0.251	1.620	1	0.203	1.376
TRADE	0.185	0.367	0.254	1	0.614	1.203
AGE * SEX	-0.012	0.034	0.133	1	0.715	0.988
SME	0.025	0.203	0.015	1	0.903	1.025
SEX	-0.146	1.607	0.008	1	0.928	0.864

Table 4 - Unrestricted logistic regression model estimation results

Source: Own elaboration, based on the SPSS Outputs (cf. Appendix 2.1).

Note: The shaded in grey independent variables are not statistically significant ($p\text{-value} > 0.05$).

At the conventional level of $\alpha = 0.05$, only 7 of the 15 variables are, for sure, statistically significant: FRACAMP ($p = 0.000$), MSDWO ($p = 0.000$), AGE ($p = 0.003$), PERM ($p = 0.009$), OVEDEV ($p = 0.016$), TRDSRVAR ($p = 0.028$) and INDAR ($p = 0.046$). The remaining 8 variables (the last ones, shaded in Table 4) may not be statistically significant, because the respective parameters present $p\text{-values} > 0.05$. In other words, none of the parameters associated with these 8 variables may be significantly different from zero.

It is therefore important to test whether the parameters associated with those variables can be considered jointly (all) equal to zero. In fact, the exclusion of only some of the 8 variables can turn significant one or more of the remaining 8. Thus, taking into

account the descending ordering of the *p-values* in the above model, the non-significant variables were successively removed up to the moment that all the parameters of the restricted version of the model presented *p-values* < 0.05 (cf. Appendices 2.1 to 2.3).

The results obtained by this way are depicted in Table 5.

Independent variables & constant	$\hat{\beta}$	S.E.	Wald	df	<i>p-value</i>	$e^{\hat{\beta}}$
Constant	-13.782	1.490	85.574	1	0.000	0.000
FRACAMP	3.331	0.312	114.022	1	0.000	27.962
MSDWO	3.416	0.594	33.042	1	0.000	30.456
AGE	0.027	0.008	11.565	1	0.001	1.028
PERM	0.554	0.193	8.222	1	0.004	1.740
OVEDEV	1.641	0.633	6.726	1	0.010	5.160
TRDSRVAR	2.557	1.047	5.961	1	0.015	12.902
INDAR	0.764	0.215	12.584	1	0.000	2.148
LARGE	0.590	0.296	3.977	1	0.046	1.805
$G^2(7) = X^2_U - X^2_R = -2LL_U - (-2LL_R)$ 747.936 - 739.960 = 7.976 < 14.067 ($p = 0.335 > \alpha = 0.05$; df = 7)						

Table 5 - Results of the restricted logistic regression model estimation and test of exclusion restrictions

Source: Elaboration based on the SPSS outputs (see Appendix 2.3) and own calculations.

The analysis of Table 5 allows seeing that, in addition to the 7 explanatory variables initially classified as significant (and whose parameters *p-values* are generally even smaller in this restricted version of the model), also the variable LARGE, considered before as non-significant, must belong to the restricted version of the model (has now $p = 0.046 < 0.05$). In fact, this restricted version passes the G^2 test for joint non-significance of the 6 variables left out of the model (see last row of Table 5, where $p = 0.335 > \alpha = 0.05$).

Restricted estimated model:

$$\ln\left(\frac{\hat{P}_i}{1 - \hat{P}_i}\right) = -13.782 + 0.764(INDAR) + 2.557(TRDSRVAR) + 1.641(OVEDEV) \\ + 3.416(MSDWO) + 3.331(FRACAMP) + 0.590(LARGE) \\ + 0.027(AGE) + 0.554(PERM) \quad (2)$$

The advantage of using a (restricted) logistic regression model (duly validated) is that it allows better parameter estimates (reduced variances, not at the cost of bias).

The restricted estimated model allows to conclude that all the above mentioned predictors have a positive impact (although a differentiated impact in terms of magnitude) on the *Logit*, thus on the *odds ratio*, and, consequently, on the probability of occurrence

of a fatal work-related accident. In particular, it is possible to verify that, *ceteris paribus*, the increase of a worker's age, the transition from a micro employer to a large employer, the change from another type of workplace to an industrial or to a trade or services workplace, the exposure to a deviation by overflow, overturn, leak, flow, vaporization or emission (instead to other type of deviation), the fact that the accident had caused a fracture, amputation, MSD or wound (instead of other type of injury) and the change of a worker's employment status to an indefinite period employment contract, all have a positive and statistically significant impact on increasing the probability of being victim of a fatal work-related accident.

These research results also allow us to answer to the hypotheses placed earlier, and discuss them in the light of the reviewed literature:

H1 - Male workers, *ceteris paribus*, have higher probability of being victims of fatal work-related accidents, must be rejected, in so far as the variable SEX is not included in the restricted logistic regression model. The same lack of statistical significance also applies to the interaction term AGE * SEX, also left out of the restricted version of the model. This conclusion is in line with Santana et al. (2003), which also found no statistically significant differences between the sexes with regard to the incidence of work-related accidents, although in contradiction with the conclusions of Zangirolani et al. (2008), that support an increased propensity of male workers to be victims of work-related accidents.

H2 - The probability of a worker being victim of a fatal work-related accident is positively correlated, *ceteris paribus*, with his age, should not be rejected, because the independent variable AGE has explanatory power for the probability of occurrence of a fatal work-related accident ($p = 0.001 < \alpha = 0.05$), as shown in Table 5 and Appendix 2.3. According to this research results, an increase of one year in the age of a worker induces, *ceteris paribus*, an increase of 0.027 on the *Logit*, therefore an increase of 1.028 on the *odds ratio* and, consequently, an increase on the probability of occurrence of a fatal work-related accident. These findings contrast with the understanding expressed by Lima et al. (1999), according to which age is not a predictor of work-related accidents, and calls into question the belief expressed in the successive Portuguese OSH strategies, concerning the existence of 'risk groups', especially vulnerable and more likely to be victims of work-related accidents, where they include, among others, young workers (Portuguese Government, 2008d, 2015e). They are consistent, however, with the growing concerns of the European Parliament, European Commission and EU-

OSHA with the ageing of the European workforce (European Commission, 2014; European Parliament, 2015). These concerns, moreover, are embodied, in particular, in the EU Strategic Framework on Health and Safety at Work 2014-2020 recently approved (European Commission, 2014), which considers the ageing of the European workforce as one of the 3 biggest challenges for OSH at European level and the definition of an approach to tackle it as one of the 7 key strategic objectives for the European OSH strategy. They also encouraged the ‘European campaign for safety and health at work 2016-2017 - healthy workplaces for all ages’, promoted by the EU-OSHA (2016a), which elected the themes of ‘safe and healthy working conditions throughout the whole working life are good for workers, business and society as a whole’ and ‘safer and healthier work at any age’.

H3 - Workers of economic activity sectors such as construction, agriculture, forestry and fishing, manufacturing, transport and storage, and wholesale and retail trade have, *ceteris paribus*, a greater propensity to be victims of fatal work-related accidents, must be rejected, because the variable PEACSC has no explanatory power for the dependent variable ACCID at the conventional significance level of $\alpha = 0.05$. Indeed, the dummy categories TRADE and MANUF of the qualitative variable PEACSC, initially included in the unrestricted model (cf. Table 4), revealed to be non-statistically significant to explain the dependent variable ACCID at the usual level of significance, having been left out in the restricted logistic regression model (cf. Table 5). The fact that the economic activity sector of the employer is not a predictor variable of fatal work-related accidents occurrence, as it holds in the present study, seems to contradict the Portuguese descriptive statistics on fatal accidents at work (Eurostat, 2016; GEP, 2016), as well as the resulting practice of assigning a greater risk, propensity or probability of work accidents occurrence exactly to the workers of the employers of the economic activity sectors that present an higher absolute and/or relative frequency and/or incidence rate of work-related accidents (such as construction; agriculture, forestry and fishing; manufacturing; transport and storage; and wholesale and retail trade), as argued by Jacinto et al. (2007) and also sustained by the successive PNSPOSH (2008d, 2015e), being those sectors commonly designated as ‘risk sectors’. It is worth noting, however, that the detected absence of statistically significant explanatory power of the economic activity sector on the occurrence of fatal work-related accidents refers specifically to the economic activity sector of the employer and not to the main economic activity sector of the establishment or of the workplace. This distinction is very im-

portant. In fact, an employer can be registered with a particular formal/main economic activity sector, but exercise other activities in various establishments and workplaces, which fit in other economic activity sectors than its formal or main one. In these circumstances, it is reasonable to assume that what should be considered is not so much the formal or main economic activity sector of the employer but mainly the sector of activity that corresponds, in fact, to the actual activities carried out in the workplace, where and when the accident occurred. This assumption, moreover, is consistent with the finding that the main economic activity sector of a given establishment has statistically significant explanatory power for the total number of work-related accidents registered in that establishment, as suggested by the results of the research on the critical factors for the (in)effectiveness of the PMOSHMS in preventing work-related accidents, discussed later. It also seems in line with the results of the research carried out on the labour inspectorates' performance assessment, which suggest that the ACT local branches relative effectiveness in preventing work-related accidents is, *ceteris paribus*, as lower as higher is the volume of the employed population in the economic activity sectors of their areas of jurisdiction that expose the workers to a higher level of occupational risks and which, typically, present higher work-related accidents incidence rates. Notwithstanding the above, these apparently contradictory results, regarding the association between the employer's economic activity sector and the occurrence of fatal work-related accidents, suggest the interest in deepening the research on this particular issue.

H4 - The type of workplace influences the probability of occurrence of a fatal work-related accident, should not be reject, once the variable WRKPLC has explanatory power regarding the dependent variable ACCID at the conventional significance level of $\alpha = 0.05$. Indeed, the dummy variables INDAR ($p = 0.000 < \alpha = 0.05$) and TRDSRVAR ($p = 0.015 < \alpha = 0.05$) – two categories of the independent variable WRKPLC - revealed to be statistically significant for the explanation of the occurrence of fatal work-related accidents, at the conventional significance level. In addition, the estimates of the parameters of the variables INDAR and TRDSRVAR as well as their exponentials, indicate that, *ceteris paribus*: i) the change from another type of workplace (reference category) to an industrial workplace induces an increase of 0.764 on the *Logit*, therefore an increase of 2.148 on the *odds ratio* and, consequently, an increase on the probability of occurrence of a fatal work-related accident; ii) the change of another type of workplace (reference category) to a trade or services workplace causes an increase of 2.557 on the *Logit*, therefore an increase of 12.902 on the *odds ratio* and, con-

sequently, an increase on the probability of occurrence of a fatal work accident. These evidences, suggesting that the type of workplace is a predictor variable for the occurrence of fatal work-related accidents, although consistent with the understanding of Eurostat (2001) of the need for its inclusion in the ESAWCM, contradicts the understanding expressed by Jacinto et al. (2007), according to which the type of workplace is irrelevant and subsumed in the economic activity sector of the employer. Not just because the results of this research indicate that the economic activity sector of the employer has no explanatory power for the occurrence of fatal work-related accidents, as seen before, but mostly because, as suggested by these findings, what seems more relevant appears to be the type of workplace where the worker is in fact working at the time of the accident, instead of the economic activity sector of his employer. If, for absurd, it was otherwise, one would have to accept that a worker of a construction company that only works at his headquarters office would have a higher probability of being victim of a fatal work-related accident than a temporary worker whose workplace is a construction site.

H5 - Micro enterprises and SMEs workers have, *ceteris paribus*, higher probability of having fatal work-related accidents, should be rejected. In fact, the results of this research allow us to confirm the exact opposite of the hypothesis set out: the workers of large employers are the ones, *ceteris paribus*, that have a higher probability of being victims of fatal work-related accidents. Notice that the dummy variable LARGE (resulting from the recoding of SIZE), revealed to have explanatory power, statistically significant at conventional significance level (with $p = 0.046 < \alpha = 0.05$). On the contrary, the variable SME (also resulting from the recoding of SIZE), initially entered in the complete model, has been left out of the restricted logistic regression model. These results suggest that a worker moving from a micro employer (reference category) to a large employer induces, *ceteris paribus*, an increase of 0.590 on the *Logit*, therefore an increase of 1.805 on the *odds ratio* and, consequently, an increase on the probability of being victim of a fatal work-related accident. These findings seem consistent with the results of the research carried out on the following topic of this study (on the critical factors for the (in)effectiveness of the PMOSHMS in preventing work-related accidents), which suggest that the size of the employer (in terms of the number of persons at his service, gross value added or business volume) do not have statistically significant individual explanatory power for the total number of work-related accidents occurring in an establishment. It also appears consistent with the findings of the research on that

latter topic, which demonstrate that the larger is a given establishment (not the employer), in terms of the average number of persons working there (i.e., employees and workers of other employers, including subcontractor's workers, temporary workers and self-employed workers), the more likely is the occurrence of a work-related accident. Moreover, and although consistent with the thesis of the size factor relevance in work-related accidents occurrence, supported by several researchers (Legg et al., 2015; Micheli & Cagno, 2010; Sørensen et al., 2007), this research results contradict, however, the understanding that the probability of smaller employers' workers to be victims of work-related accidents is higher than that of the larger employers' workers due to the SMEs specific characteristics and usual resource constraints, to their increased difficulties in complying with the labour and OSH regulations and, therefore, to their higher problems in ensuring decent and safe working conditions to their workers, as argued by several research studies (Baldock et al., 2006; Enrico Cagno et al., 2013, 2011; European Parliament, 2014; Gallagher et al., 2001; Hasle et al., 2009; Hasle, Kvorning, et al., 2012; Hasle & Limborg, 2006; Hasle, Limborg, et al., 2012; Laird et al., 2011; Legg et al., 2015; Mayhew & Peterson, 1999; Micheli & Cagno, 2010; Morse et al., 2004; Okun et al., 2001; Sørensen et al., 2007; Stevens, 1999; Targoutzidis et al., 2014; David Walters, 2006). These findings, moreover, seem also to contradict the Portuguese descriptive statistics on fatal accidents at work (Eurostat, 2016; GEP, 2016), as well as the consequent understanding of the micro enterprises and SMEs as 'risk companies' in the successive PNSPOSH (Portuguese Government, 2008d, 2015e). These concerns, regarding the SMEs difficulties in complying with the labour and OSH regulations, have already led to the *ex post* evaluation of the EU 28 OSH regulatory framework (24 EU OSH directives), in order to improve it, namely through its simplification, the minimization of its administrative burdens to the SMEs, whilst maintaining the same level of protection (COWI, 2015). They also encouraged the definition, in the EU Strategic Framework on Health and Safety at Work 2014-2020, as key strategic objectives, to simplify the existing legislation and to facilitate compliance with OSH legislation, particularly by micro and small enterprises (European Commission, 2014). These apprehensions, about the ability of the micro enterprises and the SMEs to put in place effective and efficient risk prevention measures, also led to the inclusion, in the PNSPOSH for 2015-2020, of the objectives of supporting the micro enterprises and the SMEs in the implementation of OSH management systems and to provide tools to help them integrate the prevention in their organizations (Portuguese Government, 2015e). In this

context, one possible explanation for the finding that the workers of larger employers are more likely to be victims of fatal work-related accidents might be the fact that larger employers have necessarily a larger number of workers exposed to occupational risks and, thus, an increased difficulty to manage OSH, especially in contexts involving a greater number of workers, spread over a larger number of workplaces and exposed to a higher number of different risk factors (in particular at the level of planning, organization and control). One other possible explanation might be due to the underreporting of work-related accidents by the SMEs, as suggested by several researchers (Legg et al., 2015; Morse et al., 2004; Sørensen et al., 2007; Stevens, 1999). Particularly considering that work-related accidents suggest the existence of OSH dysfunctions and non-conformities at the workplaces (ILO, 2003) and taking into account that, according to the EU-OSHA (2014), one of the major reasons for the Portuguese employers to address OSH is to avoid fines from the labour inspectorate (cited by about 93% of the inquired establishments). In either case, however, the truth seems to lie in the fact that these mixed and apparently contradictory results, regarding the association between the size of the employers and the occurrence of fatal occupational accidents, indicate the need for further research on this particular area.

H6 - *Ceteris paribus*, the more precarious is the worker's employment status, the greater is its likelihood of being victim of a fatal work-related accident, should be rejected. Indeed, on the contrary, the results suggest that, *ceteris paribus*, the more stable is the employment status of a worker, the greater its propensity to be victim of a fatal work-related accident. The results of the study indicate that the dummy variable PERM (resulting from the recoding of EMPSTAT) revealed to have explanatory power, statistically significant at the conventional significance level (with $p = 0.004 < \alpha = 0.05$). The other two dummy variables in which the variable EMPSTAT has been recoded (FIXTERM and TEMP) revealed, however, to be statistically non-significant to explain the dependent variable ACCID, being both left out of the logistic restricted regression model. The results also show that moving from the employment status reference category OTHEMPSTAT (other employment status) to a PERM employment status (indefinite period employment contract situation) implies an increase of 0.554 on the *Logit*, therefore an increase of 1.740 on the *odds ratio* and, consequently, an increase on the probability of occurrence of a fatal work-related accident. These findings, although consistent with the conclusion of Zangirolani et al. (2008), that the self-employed have a lower propensity to suffer work-related accidents than workers with other employment

status, contradicts Santana et al. (2003) findings, according to which there are no statistically significant differences in the propensity to be victims of work-related accidents between workers with different employment status. They also collide with the thesis that the precariousness of labour relations induces a greater propensity for the occurrence of work-related accidents, as advocate by numerous researchers (Gallagher & Underhill, 2012; Gallagher et al., 2001; Lippel et al., 2011; Underhill & Quinlan, 2011) and also subscribed by the PNSPOSH which, in this regard, considers the temporary workers, undeclared workers and self-employed as incorporating the so-called 'risk groups' or 'particularly vulnerable groups' (Portuguese Government, 2008d, 2015e).

H7 - The loss of control and falls are the two types of deviations that more likely give rise to fatal work-related accidents, should be rejected, since, *ceteris paribus*, the type of deviation more likely to cause fatal work-related accidents in Portugal is the deviation by overflow, overturn, leak, flow, vaporization or emission, as the results of this research topic demonstrate. Indeed, the results of this research indicate that the dummy variable OVEDEV (resulting from the recoding of DEVIAT) revealed to have explanatory power, statistically significant at the conventional significance level (with $p\text{-value} = 0.010 < \alpha = 0.05$). The results also suggest that, *ceteris paribus*, the exposure of a worker to a deviation by overflow, overturn, leak, flow, vaporization or emission, to the detriment of other type of deviation (reference category), implies an increase of 1.641 on the *Logit*, therefore an increase of 5.160 on the *odds ratio* and, consequently, an increase on the probability of being victim of a fatal work-related accident. These findings contradict the understanding proposed by Jacinto et al. (2007), according to which the deviations that more lead to fatal work-related accidents are the 'loss of control' and 'slipping with fall'.

H8 - The types of injuries more likely to cause fatal work-related accidents are, *ceteris paribus*, the concussions and internal injuries, should be rejected, since the types of injuries more likely to cause fatal work-related accidents in Portugal, according to this research findings are, *ceteris paribus*, and in this order, MSD or wounds and fractures or amputations. In fact, according to the results obtained, both dummy categories MSDWO and FRACAMP in which was recoded the independent variable INJURY (type of injury produced by the work-related accident) are included in the restricted logistic regression model (both with $p\text{-values} = 0.000 < \alpha = 0.05$, despite the greater Wald value for FRACAMP). Furthermore, the figures presented for the estimates of those variable parameters, as well as for the respective exponentials, demonstrate that, *ceteris*

paribus: i) Worker's exposure to MSD or wounds, rather than to other type of injury included in the reference category, translates into an increase of 3.416 on the *Logit*, therefore an increase of 30.456 on the *odds ratio* and, consequently, an increase on the probability of being victim of a fatal work-related accident; ii) Worker's exposure to fractures or amputations, instead of to other types of injury included in the reference category, results in a smaller increase of 3.331 on the *Logit*, therefore a smaller increase of 27.962 on the *odds ratio* and, consequently a smaller increase on the probability of being victim of a fatal work-related accident.

As already mentioned, the advantage of using a restricted logistic regression model (duly validated) is that it allows better parameter estimates, therefore better forecasts for the probability of occurrence of a fatal work-related accident. In this perspective, and in order to calculate the probability of occurrence of a fatal work-related accident in Portugal, the estimated restricted logistic regression model Equation (2) should be used.

To ensure the consideration of all combinations of the possible observations for each of the categories included in the restricted model, it becomes necessary the construction of 72 models that translate the various possible combinations of values (1 or 0) to be undertaken by those categories. Given the very large number of possibilities for calculating the probabilities of occurrence of a fatal work-related accident for all the possible ages of the workers, it was decided, for the sake of illustration, to fix the worker's age at 60 years old.

As such, and to calculate, for example, the probability of occurrence of a fatal work-related accident with a 60-year-old worker, hired by a large employer on the basis of an indefinite period employment contract to work in a trade or services area, exposed to a deviation by overflow, overturn, leak, flow, vaporization or emission, likely to cause MSD or wounds (AGE=60; LARGE=1; PERM=1; TRDSRVAR=1; INDAR=0; OVEDEV=1; MSDWO=1; FRACAMP=0), we use the following expression:

$$\ln\left(\frac{\hat{P}_i}{1 - \hat{P}_i}\right) = -13.782 + 2.557 + +1.641 + 3.416 + 0.59 + (0.027 * 60) + 0.554$$

$$= -3.404 \quad (3)$$

Once calculated the *Logit*, the probability itself results from the following equation:

$$\hat{p}_i = \frac{e^{y_i}}{1+e^{y_i}} = \frac{e^{-3.404}}{1+e^{-3.404}} = \frac{0.033240044}{1+0.033240044} = 0.032171 \quad (4)$$

Therefore, one might conclude that the probability of an individual under these conditions being victim of a fatal work-related accident is approximately of 0.032, i.e., 3.2% of the workers in the situation described above are victims of a fatal work-related accident.

The following Table 6 sums up the probability of a worker with 60-year-old being victim of a fatal work-related accident, based on the referred 72 models, depending on the employer's size, workplace type, type of deviation (which might cause the work-related accident), type of injury (produced by the work-related accident) and nature of his employment status.

MODEL NUMBER	FATAL WORK-RELATED ACCIDENTS PREDICTORS												PROBABILITY OF OCCURRENCE OF A FATAL WORK- RELATED ACCI- DENT	% OF SITUA- TIONS WHERE FATAL WORK- RELATED ACCI- DENT OCCURS
	VARIABLES						CATEGORIES							
	SIZE	WRKPLC	DEVIAT	INJURY	EMPSTAT	LARGE	TRDSRVAR	INDAR	OVEDEV	MSDWO	FRACAMP	PERM		
1	LA	TR	OV	MW	PE	1	1	0	1	1	0	1	0.032171	3.21
2					OS	1	1	0	1	1	0	0	0.018743	1.87
3				FA	PE	1	1	0	1	0	1	1	0.029627	2.96
4					OS	1	1	0	1	0	1	0	0.017242	1.72
5				OI	PE	1	1	0	1	0	0	1	0.001091	0.11
6					OS	1	1	0	1	0	0	0	0.000627	0.06
7			OD	MW	PE	1	1	0	0	1	0	1	0.006400	0.64
8					OS	1	1	0	0	1	0	0	0.003688	0.37
9				FA	PE	1	1	0	0	0	1	1	0.005882	0.59
10					OS	1	1	0	0	0	1	0	0.003388	0.34
11				OI	PE	1	1	0	0	0	0	1	0.000212	0.02
12					OS	1	1	0	0	0	0	0	0.000122	0.01
13		ID	OV	MW	PE	1	0	1	1	1	0	1	0.005503	0.55
14					OS	1	0	1	1	1	0	0	0.003170	0.32
15				FA	PE	1	0	1	1	0	1	1	0.005057	0.51
16					OS	1	0	1	1	0	1	0	0.002912	0.29
17				OI	PE	1	0	1	1	0	0	1	0.000182	0.02
18					OS	1	0	1	1	0	0	0	0.000104	0.01
19			OD	MW	PE	1	0	1	0	1	0	1	0.001071	0.11
20					OS	1	0	1	0	1	0	0	0.000616	0.06
21				FA	PE	1	0	1	0	0	1	1	0.000984	0.10
22					OS	1	0	1	0	0	1	0	0.000566	0.06
23				OI	PE	1	0	1	0	0	0	1	0.000035	0.00
24					OS	1	0	1	0	0	0	0	0.000020	0.00
25		OW	OV	MW	PE	1	0	0	1	1	0	1	0.002571	0.26
26					OS	1	0	0	1	1	0	0	0.001479	0.15
27				FA	PE	1	0	0	1	0	1	1	0.002362	0.24
28					OS	1	0	0	1	0	1	0	0.001359	0.14
29				OI	PE	1	0	0	1	0	0	1	0.000085	0.01
30					OS	1	0	0	1	0	0	0	0.000049	0.00
31			OD	MW	PE	1	0	0	0	1	0	1	0.000499	0.05
32					OS	1	0	0	0	1	0	0	0.000287	0.03
33				FA	PE	1	0	0	0	0	1	1	0.000459	0.05
34					OS	1	0	0	0	0	1	0	0.000264	0.03
35				OI	PE	1	0	0	0	0	0	1	0.000016	0.00
36					OS	1	0	0	0	0	0	0	0.000009	0.00
37	OE	TR	OV	MW	PE	0	1	0	1	1	0	1	0.018092	1.81
38					OS	0	1	0	1	1	0	0	0.010477	1.05
39				FA	PE	0	1	0	1	0	1	1	0.016643	1.66
40					OS	0	1	0	1	0	1	0	0.009632	0.96
41				OI	PE	0	1	0	1	0	0	1	0.000605	0.06
42					OS	0	1	0	1	0	0	0	0.000348	0.03
43			OD	MW	PE	0	1	0	0	1	0	1	0.003558	0.36
44					OS	0	1	0	0	1	0	0	0.002048	0.20

MODEL NUMBER	FATAL WORK-RELATED ACCIDENTS PREDICTORS												PROBABILITY OF OCCURRENCE OF A FATAL WORK- RELATED ACCI- DENT	% OF SITUA- TIONS WHERE FATAL WORK- RELATED ACCI- DENT OCCURS
	VARIABLES						CATEGORIES							
	SIZE	WRKPLC	DEVIAT	INJURY	EMPSTAT	LARGE	TRDSRVAR	INDAR	OVEDEV	MSDWO	FRACAMP	PERM		
45	ID	OV	FA	PE	0	1	0	0	0	1	1	0.003269	0.33	
46				OS	0	1	0	0	0	1	0	0.001881	0.19	
47			OI	PE	0	1	0	0	0	0	1	0.000117	0.01	
48				OS	0	1	0	0	0	0	0	0.000067	0.01	
49			MW	PE	0	0	1	1	1	0	1	0.003058	0.31	
50				OS	0	0	1	1	1	0	0	0.001759	0.18	
51			FA	PE	0	0	1	1	0	1	1	0.002809	0.28	
52				OS	0	0	1	1	0	1	0	0.001616	0.16	
53			OI	PE	0	0	1	1	0	0	1	0.000101	0.01	
54				OS	0	0	1	1	0	0	0	0.000058	0.01	
55			MW	PE	0	0	1	0	1	0	1	0.000594	0.06	
56				OS	0	0	1	0	1	0	0	0.000341	0.03	
57			FA	PE	0	0	1	0	0	1	1	0.000546	0.05	
58				OS	0	0	1	0	0	1	0	0.000314	0.03	
59		OI	PE	0	0	1	0	0	0	1	0.000020	0.00		
60			OS	0	0	1	0	0	0	0	0.000011	0.00		
61		OV	MW	PE	0	0	0	1	1	0	1	0.001427	0.14	
62				OS	0	0	0	1	1	0	0	0.000820	0.08	
63		FA	PE	0	0	0	1	0	1	1	0.001311	0.13		
64			OS	0	0	0	1	0	1	0	0.000754	0.08		
65		OI	PE	0	0	0	1	0	0	1	0.000047	0.00		
66			OS	0	0	0	1	0	0	0	0.000027	0.00		
67		MW	PE	0	0	0	0	1	0	1	0.000277	0.03		
68			OS	0	0	0	0	1	0	0	0.000159	0.02		
69		FA	PE	0	0	0	0	0	1	1	0.000254	0.03		
70			OS	0	0	0	0	0	1	0	0.000146	0.01		
71		OI	PE	0	0	0	0	0	0	1	0.000009	0.00		
72			OS	0	0	0	0	0	0	0	0.000005	0.00		

Table 6 - Calculation of the probabilities of 60 year's old worker being victim of a fatal work-related accident based on the estimated restricted logistic regression model Equation (2) and according to each of the 72 defined models

Source: Own calculations, based on the restricted logistic regression model Equation (2).

Notes:

1. Model fixed values: Constant = -13.782; AGE = 60;
2. Employer's size: LA - Large; OE - Other employer's size;
3. Types of workplace: TR - Trade or services workplace; ID - Industrial workplace; OW - Other workplace types;
4. Types of deviation: OV - Overflow, overturn, leak, flow, vaporization or emission; OD - Other deviation types;
5. Types of injury: MW - Musculoskeletal disorders or wounds; FA - Fractures or amputations; OI - Other injury types;
6. Worker's employment status: PE - Permanent; OS - Other employment status.

3.5 Concluding remarks

The modelling carried out under the scope of this research topic, leads to the conclusion that the predictors for fatal work-related accidents are the following independent variables: type of workplace, type of deviation that caused the accident, type of injury produced by the accident, employer's size, worker's age and worker's employment status.

It suggests, moreover, that the independent variables sex (and its interaction with the worker's age) as well as the employer's economic activity sector have no explanatory power for the occurrence of fatal work-related accidents in Portugal.

It also indicates that, similarly to the variable AGE, all categories of the qualitative variables present in the restricted version of the model have (relative to their reference category and *ceteris paribus*) a positive marginal impact on the *Logit*, thus on the *odds*

ratio and, consequently, on the probability of occurrence of a fatal work-related accident. This marginal impact on the *Logit* (measured by the estimated value of its parameter), is however different, varying between a maximum value of 3.416 (for the category MSDWO, when compared with the reference category OTHINJ) and a minimum value of 0.027 (for the variable AGE). These marginal impacts on the *Logit* imply increases on the *odds ratio* of 30.456 and 1.028, respectively. In turn, these increments on the *odds ratio* imply increases on the probability of occurrence of fatal work-related accidents. The final values of those probabilities are shown above (cf. Table 6).

The restricted model also allows to conclude that the worker's probability of being victim of a fatal work-related accident is, *ceteris paribus*: i) As higher as older; ii) The greater the more stable and predictable is his employment status; iii) Higher when he works for a large employer; iv) Higher when he works in a trade or services area or in an industrial area, and particularly higher when he works in the former; v) Higher when he is exposed to a deviation by overflow, overturn, leak, flow, vaporization or emission; and vi) Higher when he suffers a MSD, wound, fracture or amputation.

3.6. Main policy implications

The results of the research on this topic suggest that the improvement of the effectiveness and efficiency of the fight against the most serious (fatal) work-related accidents in Portugal is a function of the extent to which the efforts and national resources are focused on the implementation of measures and public policies especially designed to prevent and protect the safety and health of older permanent workers, hired by large employers, operating in trade/services or industrial workplaces, exposed to deviations by overflow, overturn, leak, flow, vaporization or emission, likely to cause MSD, wounds, fractures or amputations.

The results of this study also suggest the convenience of enrich the Portuguese statistics on accidents at work, by collecting additional data regarding other variables that may be able to explain the occurrence of fatal accidents at work. For the sake of explanation convenience, they are described in detail in points 3 and 4 of the following section.

Finally, this research results suggest the need for the implementation of mechanisms and procedures likely to ensure the collection, processing and timely publicity of official data concerning accidents at work in Portugal, as well as the need for greater rigor

in the collection of data in respect of each work-related accident, in order to minimize the classification of observations in residual categories (such as ‘no information’) of the respective variables. Indeed, the relevance of collecting, examining and providing reliable and timely statistical data and scientific studies in the field of work-related accidents, in order to improve the quality of policy decisions in this area, has already been acknowledge by the European Commission (2014) and by the ILO (2017) and has even encourage the focus of the ILO’s campaign for the 2017 World Day for Safety and Health at Work on the critical need for countries to improve their capacity to collect and utilize reliable OSH data (ILO, 2017).

3.7 Main limitations

Among the main limitations and difficulties of the research on this particular topic, it is especially important to highlight the following:

1. Absence of official statistics and data on fatal and non-fatal work-related accidents occurring in Portugal in the year 2015 which, moreover, makes it impossible to measure the representativeness level of the convenience sample used in this research. The publication backlog time of the Portuguese official statistics on accidents at work is over two years. The most recent official statistics on work-related accidents in Portugal were published in October of 2016 and refer to the work-related accidents occurred in 2014 (Eurostat, 2016; GEP, 2016).
2. Lack of information in many individuals, especially in the case of fatal accidents at work, with respect to variables such as ‘type of workplace’, ‘type of deviation’, ‘contact - mode of injury’, ‘material agent of contact - mode of injury’, ‘type of injury’ and ‘part of body injured’, what determines their classification in its respective category ‘no information’ (codes ‘00’ and ‘000’ of the ESAW classification methodology of Eurostat (2001)), as already stressed by Jacinto et al. (2007). This led to the exclusion, from the sample used in this research, of a total of 282 accidents at work (129 fatal and 153 non-fatal), corresponding to about 20% of all accidents at work initially included in the data, which penalized disproportionately the fatal work-related accidents, to the extent that the reduction operated corresponded to a decrease of about 38% on the number fatal accidents at work considered, against a decrease of 14% on the non-fatal ones.

3. Absence of official data covering a wide range of variables, recommended by the Eurostat (2001) ESAW and likely to contribute to a better understanding of the occurrence of accidents at work, in particular: ‘type of work - working process’, ‘workstation’, ‘specific physical activity’ (and his associated ‘material agent’) and the ‘material agent of the deviation’.
4. Lack of data relating to a number of variables that the reviewed literature considers having explanatory power, at statistically significant levels, to the occurrence of accidents at work, in particular: number of hours of professional and OSH training and number of years of professional experience in the task/function (Bellamy & Geyer, 1992; Bird, 1974; Dwyer, 1991; Nunes, 2010; Spangenberg et al., 2003; Stave & Törner, 2007); level of completed education (Bellamy & Geyer, 1992; Dwyer, 1991; Lima et al., 1999; Spangenberg et al., 2003); method of organization of work/task (Bellamy & Geyer, 1992; Bird, 1974; Dwyer, 1991; Nunes, 2010; O’Connor & O’Connor, 2005, 2006; Reason, 1997; Stave & Törner, 2007); performance evaluation system, objectives and rewards (Adams & Thompson, 2002; Dwyer, 1991; Reason, 1997; Stave & Törner, 2007); and monthly family income (Lima et al., 1999).

By impeding the inclusion in the model of the above mentioned additional and potentially predictive variables of fatal work-related accidents, the aforesaid limitations prevented the test of their statistical significance and, eventually, might have conditioned the results that could be obtained if they were considered.

3.8 Perspectives on further research

The results of the research on this topic, along with some of its limitations, laid bare the interest on deepening the research on this field.

This is clearly the case of the association between the employer’s size and the employer’s economic activity sector and the occurrence of fatal work-related accidents, as discussed earlier. The mixing and apparently contradictory results obtained suggest the need for further research on these particular issues.

It might also constitute an interesting topic for future research, the performance of a similar research as this one, but this time with a wider range of potential explanatory variables, including, among others, the ones already mentioned in points 3 and 4 of the previous section.

Furthermore, and considering that the causality patterns of fatal, non-fatal and less serious work-related accidents are different (Hale, 2001; Jacinto et al., 2007), it would be more than welcome a research focused on the identification of the predictors of non-fatal accidents at work, which results could be compared to the ones of the present research. Such research, moreover, in order to account for the different severity of non-fatal work-related accidents, could either use the multinomial regression, in the case of understanding the non-fatal work-related accidents as non-ordinal polychotomous categorical variable, or the ordinal regression, if recognized the existence of a level (ordinal) of severity in non-fatal work-related accidents (Ferreira, 2013; Marôco, 2014).

Chapter 4 - Critical factors of the Portuguese mandatory occupational safety and health management system effectiveness in preventing work-related accidents

Chapter 4 - Critical factors of the Portuguese mandatory occupational safety and health management system effectiveness in preventing work-related accidents¹⁵

Summary

The purpose of the research on this particular topic is to identify the explanatory factors for the (in)effectiveness of the PMOSHMS in preventing work-related accidents.

A sample of 98 establishments which, in spite of having OSH services organized, recorded fatal work-related accidents in 2014, is used to estimate the multiple linear regression model.

The results show that establishment's size (average number of persons who work there), occupational safety services organization modality, number of physical risk factors identified and establishment's main activity sector are statistically significant predictors of the PMOSHMS effectiveness. They also indicate that occupational health services modality, level of coverage of the information actions, establishment's size (average number of subcontractor's workers, temporary workers and self-employed workers), organization of health promotion programs and organization of risks prevention programs have no explanatory power for the PMOSHMS effectiveness.

These findings suggest that the PMOSHMS effectiveness in preventing work-related accidents depends on the extent to which the competent authorities and other actors of the national system of occupational risk prevention focus their resources on: *in situ* technical support to improve OSHMS at workplaces (to the detriment of the mere enforcement of formal aspects); information and awareness campaigns on risks management and OSH services modalities and requirements; enforcement of legal provisions concerning risk assessment, implementation of prevention measures and OSH services functioning; and on the reinforcement of the monitoring of larger establishments, in particular of the manufacturing and construction industries.

¹⁵ A shorter version of the research on this subject is currently under review, following its submission for publication, in October 14th, 2016, to the Elsevier journal *Safety Science*, an international journal on science and technology of human and industrial safety, with peer review, indexed by Scopus (SJR Quartile: Q1; SJR: 0.928; IF: 2.157). The latter was also submitted, reviewed, accepted and presented to the 2nd International Congress on Safety and Labour Market (ICSLM) 2016, held in the University of Beira Interior, Covilhã, Portugal, in November 24th, 2016, and included in the respective book of proceedings (A. J. R. Santos, Rebelo, Almeida, & Mendes, 2016).

4.1 Introduction

Despite the growing awareness regarding the relevance of having decent, safe and healthy working conditions, the working still remains as a global phenomenon of truly pandemic proportions (Alli, 2008; Hämäläinen et al., 2009; ILO, 2005; J. Takala et al., 2014; Jukka Takala, 2005), with deeply devastating consequences at human and financial levels, to the victims of the work-related accidents and to their families, as well as to the employers and to the States (Bird & Germain, 1966, 1986; EU-OSHA, 1998; Fabela & Sousa, 2012; Freitas, 2004; Hämäläinen et al., 2009; Heinrich et al., 1980; HSE, 2015; Leigh, 2011; Miller, 1997; Nunes, 2010; Richthofen, 2002; Roxo, 2004; Sérgio Miguel, 2010; J. Takala et al., 2014; Jukka Takala, 2005).

As such, the role and effectiveness of OSHMS in preventing work-related accidents has been under discussion over the last two decades in a number of researches. Those studies tend to focus mainly in four interrelated domains: types of OSHMS and their different impact on work-related accidents (Drais et al., 2008; Frick et al., 2000; Gallagher et al., 2001); OSHMS performance measures and potential correlations between its implementation stage and work-related accidents incidence rates (Shaw, 2002; Shaw & Blewett, 1995); potential correlation between OSHMS constituent elements and work-related accidents incidence rates (Johnson, 2007; Johnstone et al., 2005; Lilley et al., 2002; Lippel et al., 2011; Quinlan et al., 2009, 2001; Redinger & Levine, 1998; Underhill & Quinlan, 2011; David Walters & Nichols, 2007); and employer's size factor impact on OSHMS effectiveness, in particular regarding SMEs (Arocena & Nuñez, 2010; E. Cagno et al., 2014; Enrico Cagno et al., 2013, 2011, Hasle et al., 2010, 2009; Hasle, Kvorning, et al., 2012; Hasle, Limborg, et al., 2012; Legg et al., 2015; Mayhew & Peterson, 1999; Micheli & Cagno, 2010; Quinlan, 1999).

Even with the contributions of such OSHMS researches, it is commonly recognized the existence of a gap in the international research on the effectiveness of OSHMS in preventing occupational accidents, particularly in view of their small number, methodological limitations and mixed and inconclusive results (Frick et al., 2000; Gallagher & Underhill, 2012; Robson et al., 2007; Stolk et al., 2012). Furthermore, in the literature review carried out within the scope of this research, it was found no empirical study, journal article or report regarding the effectiveness of OSHMS in the prevention of (fatal or non-fatal) work-related accidents in Portugal.

In addition, the available data allow us to realize that, of the 145 fatal work-related accidents recorded in Portugal in 2014, 115 (about 79%) occurred in establishments that had safety and health services organized, which raises serious questions about the nature and effectiveness of the OSHMS implemented in these establishments.

The main goal of the present research topic consists, therefore, in the identification of the critical (un)success factors of the PMOSHMS in preventing work-related accidents, so as to allow the focus of both the policy-maker's attention and the scarce resources of the competent public authorities in the fight against these (fewer) variables that inhibit OSHMS effectiveness, in order to maximize the effectiveness of the 'war' against the pandemic of work-related accidents in Portugal.

Bearing this purpose in mind, the research on this topic begins with a literature review on both OSHMS and PMOSHMS (mainly focused on its concept, nature and effectiveness) and the subsequent definition of the research hypotheses regarding the PMOSHMS effectiveness. It follows addressing the methodological aspects of the research (e.g. collection and preliminary treatment of the data, population and sample, variables considered and its selection process, and regression model specification). Subsequently, the research results are presented and, afterwards, discussed. The research concluding remarks are then presented, followed by their main policy implications. After that, the main limitations of the research are disclosed. This research concludes pinpointing possible paths for future research.

4.2 Literature review and research hypotheses

4.2.1 OSHMS concept and nature

In spite of the lack of a consensual and widely accepted definition of OSHMS (Gallagher et al., 2001; Nielsen, 2000; Robson et al., 2007), it can be defined as a set of interconnected components or interacting elements set up to create an OSH policy and to ensure the achievement of its objectives (ILO, 2001b). It can also be viewed as a mixture of elements such as planning, review, consultative activities, management organizational arrangements and specific program components that interact in an integrated manner so as to improve OSH performance (Gallagher, 2000). In this sense, it comprises the following common elements: organization, responsibility and accountability elements; consultation arrangements; and specific elements of the program. The former

include the involvement of top management, assignment of duties to intermediate managers and supervisors, management accountability, performance evaluation and organizations' OSH policy. The consultation arrangements refer to workers' OSH representatives, conflict management system, joint OSH committees and workers' participation and consultation. The latter encompass rules and procedures for OSH, training program, inspections to workplaces, communication and investigation of incidents, declaration of principles concerning the prevention and control of occupational risks, data collection and analysis, record keeping, providing relevant information about OSH, consideration of OSH aspects in relation to procurement and design, monitoring and evaluation, specific risks tackling, organization of work and definition of procedures for emergency, first aid and health surveillance (Gallagher et al., 2001). OSHMS can also be seen as an integrated set of organizational elements (e.g. health and safety policies, objectives and goals, decision-making structures and respective practices, technical resources, accountability structures and respective practices, risk assessment practices, training practices, occupational risks control, quality assessment practices, evaluation practices and organizational learning practices) involved in the continuous cycle of planning, implementation, evaluation and continuous improvement, aimed at reducing occupational risks in the workplace (Robson et al., 2005, 2007). Redinger and Levine (1998), for example, based on the revision of 13 OSHMS and Environmental Management System models, proposed a universal OSHMS. It was structured around 5 organizing categories (OSH inputs, OSH processes formulation, OSH processes implementation, evaluation/feedback and improvement/integration), which were then broken down into 16 primary sections (e.g. employee participation, OSH policy and training system) and, subsequently, into 11 secondary sections (e.g. regulatory compliance, emergency preparedness and response system, hazardous agent management system, incident investigation and medical program and surveillance).

Although different OSHMS usually present, from a conceptual and theoretical point of view, the same basic requirements, as a formal management process designed to improve OSH and made up of a complex set of interrelated elements (Gallagher et al., 2001), the reviewed literature on OSHMS tends to distinguish between mandatory and voluntary OSHMS, considering the different motivations underlying its implementation (Gallagher et al., 2001; Robson et al., 2005, 2007).

The voluntary OSHMS are intended to provide guidance on good practices in the management of OSH or to define the requirements for its certification and use to take

the form standards or guidelines (Stolk et al., 2012). In spite of not being directly linked to the fulfilment of legal requirements, they usually take them into considerations. Their adoption tends to be promoted by private consultancy companies, groups of companies, government agencies, insurance companies, professional organizations and organizations of standardization (Frick & Wren, 2000; Robson et al., 2007). When promoted by consultants and trade companies, they are generally more specific, formalized and detailed and, consequently, too complex for most of the smaller organizations; when their adoption is promoted by government agencies, they tend to be simpler and more susceptible of adaptation, once they are intended for organizations of different sizes and at different stages of the respective implementation process (Frick & Wren, 2000; Robson et al., 2007). Common examples such voluntary OSHMS include (Drais et al., 2008; Hasle & Zwetsloot, 2011; Palassis et al., 2006; Stolk et al., 2012; Zwetsloot, 2000): (1) at international level - the ILO-OSH:2001 guidelines of the ILO (ILO, 2001b); (2) at national level - the standards BS 8800:2004 and BS OHSAS 18001:2007 of the British Standards Institution (BSI, 1996, 1999, 2007); the U.S. Department of Labor Occupational Safety and Health Administration's Voluntary Protection Program (VPP); the Z10:2005 OHSMS standard of the American Standards Institute (ANSI); and the Portuguese NP 4397:2008 standard of the Portuguese Institute of Quality (IPQ) concerning the OSHMS requirements (IPQ, 2008); (3) at regional level - the Victorian *WorkCover Authority SafetyMap*; and (4) at sectoral level - the American Chemistry Council (ACC) Responsible Care management system; the DT-78 OSHMS of the French Chemical Industries Union; the MASE (*Manuel d'Amélioration de la Sécurité de l'Entreprise*) management system, developed by the French petrochemical industry grouping, to frame the interventions of external companies; the CEFIC (*Conseil Européen des Fédérations de l'Industrie Chimique*) Safety and Quality Assessment System (SQAS), applicable to dangerous goods logistics; the Occupational Health and Safety Management System Guidance Document of the American Industrial Hygiene Association (AIHA); and the Environmental, Health and Safety Management System (EHSMS) Model of the American Petroleum Institute (API).

The mandatory OSHMS, in turn, derive from the legislation and their application is enforced through the labour or OSH inspection services. They are usually simpler than the volunteers, as they are aimed at a wider range of different organizations with different dimensions, working in various sectors of activity (Robson et al., 2007) and due to the inability of the public authorities to control the implementation of excessively de-

tailed standards and its interest in avoiding the imposition of excessive and disproportionate context costs (bureaucratic and administrative burdens) to the economic agents (Frick & Wren, 2000). Examples of this type of systems include, besides the one established by the framework Council Directive No. 89/391/EEC, of June 12, 1989 (European Council, 1989a; Karageorgiou et al., 2000; David Walters, 2002), the majority of the legal regimes for promoting OSH in force in the EU 28 countries, such as the Portuguese legal framework for the promotion of OSH, regulated by the Law No. 102/2009, of September 10, 2009 (Portuguese Parliament, 2009a), as well as the French SGS (*Système de Gestion de la Sécurité*), which is a OSHMS applicable in France, since 2001, to companies classified as Seveso in the framework legislation concerning technological risks (Drais et al., 2008).

4.2.2 PMOSHMS

Regardless of the adoption of any aforementioned voluntary OSHMS, all employers who pursue their activity in Portugal are obliged to comply with the national legislation with impact on the safety and health of their workers. In particular, those directly applicable and enshrined in the Constitution of the Portuguese Republic regarding fundamental rights, freedoms and guarantees, namely the ones concerning personal rights (to life, to personal integrity, to liberty and security, to freedom of expression and information, freedom to learn and teach, freedom of assembly and demonstration, freedom of association, freedom of choice of profession and to equality) and worker's rights (to job security and the prohibition of dismissal without just cause, to the creation of worker's committees, to freedom of association and strike and the prohibition of lock-out) (Portuguese Parliament, 1976:articles 13,16,18,24,25,27,37,43,45-47,53-55,57). Moreover, they are also required to abide by a set of other, economic and social rights, with impact on safety and health at work, and equally deserving constitutional custody, such as (Portuguese Parliament, 1976:articles 59,64): organization of work in dignified conditions; conditions of hygiene, safety and health at work; limits setting on the duration of the work; rest, leisure and maximum working hours; weekly rest and periodic holidays with pay; assistance and fair repair, when victim of an accident at work or occupational disease; special protection of women during pregnancy and after delivery, as well as the work of minors, of diminished and those who perform activities particularly vio-

lent or unhealthy, toxic or dangerous; and health protection, in particular through access to preventive medicine, curative care and rehabilitation.

The employers operating in Portugal, have also to comply with the legal provisions on safety and health at work foreseen in the legal framework for the promotion of safety and health at work (Portuguese Parliament, 2009a). This legal framework which transposes to the internal legal order the European Council (1989a) framework Directive No. 89/391/EEC, of 12 June 1989, concerning the introduction of measures to encourage improvements in the safety and health of workers at work, already incorporates the predictions of ILO (1981) Convention No. 155, concerning OSH and the working environment and the provisions of articles 281 and 282 of the Portuguese Labour Code (Portuguese Parliament, 2009d).

In addition, employers who develop their activity in Portugal must also comply with, where applicable, the legal provisions foreseen in various special legal acts, in particular relating to: minimum health and safety requirements at the workplace (and respective technical standards); minimum requirements for signaling safety and health at work; minimum safety and health of workers in the use of personal protective equipment (and respective technical standards); legal system of fire safety in buildings and respective technical regulation; minimum health and safety requirements applicable due to the nature of the workplace and/or the sector of activity concerned (*e.g.* minimum health and safety requirements applicable to workplaces, commerce and services establishments, industrial establishments, construction sites, mines and quarries and to work on board fishing vessels); minimum health and safety requirements applicable to the exposure of workers to specific risks (*e.g.* noise, mechanical vibration, chemical agents, biological agents, carcinogens, mutagens, asbestos, arising from the use of display screen equipment, ionizing radiation, optical radiation from artificial sources, MSD associated with manual handling of loads or inadequate work postures, arising out of the use of machinery and work equipment, from explosive atmospheres, arising from injuries caused by medical devices cut-perforating and derived from the contained use of genetically modified organisms and genetically modified organisms); and the prevention of serious industrial accidents or involving dangerous substances (Portuguese Government, 1958, 1965, 1996a, 1996b, 1996c, 1997a, 1997b, 2000b, 2003a, 2003b, 2005, 2006a, 1971, 2006b, 2007a, 2007b, 2008a, 2008b, 2008c, 2012a, 2013, 2015a, 2015c, 1980, 1986, 1990, 1993a, 1993b, 1993c, 1995a, Portuguese Parliament, 2009a, 2010).

Therefore, besides imposing a series of obligations on the State itself, the Portuguese legal framework for the promotion of safety and health at work (Portuguese Parliament, 2009a) also imposes to all employers the compliance with a series of legal obligations and the adoption of a series of mandatory practices. When taken together, these obligations and practices are not more than a true mandatory OSHMS.

This PMOSHMS model can be defined as synthetically described in Table 7, taking into account its elements or components, as well as the dimensions around which those are structured and articulate, as provided for in the Law No. 102/2009 (Portuguese Parliament, 2009a):

PMOSHMS components		Law 102/2009
Code	Description	applicable provisions
I. OSH planning		
1.1	Plan OSH in accordance with the general principles of prevention.	Article 15/2
1.2	Plan OSH as a coherent system that integrates the technical developments, the organisation of work, working conditions, social relationships and the influence of environmental factors.	Article 15/2/b
1.3	Plan OSH considering the integration, at all levels and for all the company's activities, the risk assessment and the resulting prevention measures.	Article 73-B/1/a
1.4	Develop an occupational risk prevention plan, as well as detailed plans of prevention and protection required by specific legislation.	Article 73-B/1/c
1.5	Formulate the internal emergency plan, including specific plans for first aid, fire-fighting and evacuation of premises.	Article 73-B/1/d
1.6	Design an information program for the promotion of OSH and for the integration of preventive measures in the information and communication systems of the employer.	Article 73-B/1/l
1.7	Design an OSH promotion training program.	Article 73-B/1/m
II. OSH organization and implementation		
2.1	Organize the establishment OSH services in accordance with the terms and conditions provided for in the law: Safety services - internal, external, shared, provided by employer or provided by designated worker; Health services-internal, external, shared or provided by national health service. Mobilise the necessary resources at the level of the technical activities of prevention, training and information. Provide the necessary protection equipment.	Articles 15/10 and 73 to 110
2.2	Organize the preventive services having regard to third parties who may also be exposed to risks and ensure adequate cooperation and coordination between employers at the same workplace.	Articles 15/7 and 16
2.3	Identify the foreseeable risks in all activities of the undertaking, establishment or service, in the design or construction of facilities, premises and work processes, as well as in the selection of equipment, substances and products, with a view to eliminating them or, when this is not feasible, to reduce its effects.	Article 15/2/c
2.4	Assess the risks and prepare the respective reports.	Article 73-B/1/b
2.5	Implement the appropriate safety and health prevention measures.	Article 73-B/1/o
2.6	Integrate the risks assessment in all the activities of the undertaking, establishment or service. Adopt appropriate measures of protection. The preventive measures to implement must result from the various stages of the production process risks assessment.	Article 15/2/d and 15/3
2.7	Selecting and designing workplaces, equipment and methods of work organisation in accordance with the general principles of prevention.	Article 73-B/1/e
2.8	Combat risks at source, in order to eliminate or reduce exposure and increase protection levels.	Article 15/2/e
2.9	Ensure that exposures to chemical, physical and biological agents and psychosocial risk factors do not constitute a risk to the safety and health of workers.	Article 15/2/f
2.10	Adapt the work to the workers, especially in what regards the design of workplaces, the choice of work equipment and methods of work and production.	Article 15/2/g
2.11	Adapt the work to technical evolution as well as to new forms of organization.	Article 15/2/h
2.12	Replace the dangerous by the non-dangerous or less dangerous.	Article 15/2/i
2.13	Give priority to collective protective measures in relation to individual ones.	Article 15/2/j
2.14	Produce and disseminate instructions understandable and appropriate to worker's activities.	Article 15/2/l
2.15	Adopt measures and give instructions so that workers, in a situation of serious and imminent danger that cannot be avoided, can cease the activity and back off from danger.	Article 15/6
2.16	Develop health promotion activities. Promote the health surveillance of workers, in particular by ensuring the admission, regular and occasional health exams. Ensure reporting and the issuance of fitness certificates. Organize and maintain updated clinical records.	Articles 15/8, 44 to 46, 73-B/1/g and 103 to 110
2.17	Establish an internal structure that ensures the emergency activities (first aid, fire-fighting and evacuation of premises).	Articles 15/9, 73.º-B/1/i and 75

PMOSHMS components		Law 102/2009
Code	Description	applicable provisions
2.18	Ensure the special protection of the genetic heritage of workers and refrain from exposing workers to legally forbidden or conditioned activities.	Articles 41 to 47 and 72
2.19	Consult workers on safety and health at work.	Articles 18 and 73-B/1/n
2.20	Provide appropriate information to workers in the field of safety and health at work, as well as to their OSH representatives.	Articles 15/2/l, 15/4, 15/6, 15/10, 19, 73-B/1/l) and 73-B/1/n
2.21	Ensure adequate training for workers in the field of safety and health at work.	Articles 15/4, 15/5, 15/10, 20 and 73-B/1/m
2.22	Control the supply, the validity and preservation of personal protection equipment and the installation and maintenance of safety signs.	Article 73-B/1/f
III. OSH evaluation, monitoring and feedback		
3.1	Collect and organize the data required for mandatory notices and communications	Articles 73-B/1/p and 112
3.2	Issue the mandatory notification in the event of a work-related accident or occupational disease.	Articles 73-B/1/q and 111
3.3	Perform periodic audits and internal inspections and support external ones.	Article 73-B/1/r
3.4	Analyze the causes of work-related accidents and occupational diseases and draw up the respective reports.	Article 73-B/1/s
3.5	Collect, organize and maintain updated the statistical elements concerning OSH.	Article 73-B/1/t
3.6	Analyze and maintain up to date, for consultation, the following elements:	
3.6.1	Results of occupational risk assessments;	Article 73-B/2
3.6.2	List of accidents that have raised absence for incapacity for work, as well as accidents or incidents that assume particular gravity from the perspective of safety at work;	
3.6.3	Reports on work-related accidents that entail absence due to incapacity for work or revealing evidence of particular gravity from the perspective of safety at work;	
3.6.4	List of sick leave and the number of days of absence from work;	
3.6.5	List of measures, proposals or recommendations made by the OSH services.	
3.7	Keep the documentation relating to the realization of all OSH management activities at the disposal of the competent inspection authorities for five years.	Article 73-B/5

Table 7 - PMOSHMS model

Source: Own interpretation, based on Portuguese Parliament (2009a).

4.2.3 OSHMS effectiveness and research hypotheses

As discussed earlier, several researches have been devoted to the investigation of OSHMS effectiveness over the last two decades. Those studies are mainly focused on the impact of OSHMS on work-related accidents, either considering the number and nature of such reported or unreported events (near misses, non-fatal or fatal work-related accidents), their incidence rates or the induced days of absence.

A number of researches have also targeted the identification of explanatory variables for OSHMS effectiveness in preventing work-related accidents, which are not necessarily either OSHMS components or work-related accidents causes. These predictor variables allow the characterization of workers, employers and the context in which the activity is developed and, based on such characteristics, the prediction of the occurrence of work-related accidents. Employer's size, for example, either in terms of the number of workers or business volume is often pointed out as an important factor for OSHMS effectiveness in the prevention of work-related accidents (Eurostat, 2001; Jacinto et al., 2007; Laird et al., 2011; Legg et al., 2015; Micheli & Cagno, 2010; Sørensen et al., 2007; Yorio & Wachter, 2014). Especially in the case of SMEs, whose specific charac-

teristics are often argued to constitute real barriers to the implementation and maintenance of safe and healthy working environments (Baldock et al., 2006; Enrico Cagno et al., 2011; Gallagher et al., 2001; Hasle et al., 2009; Hasle, Kvorning, et al., 2012; Hasle & Limborg, 2006; Hasle, Limborg, et al., 2012; Legg et al., 2015; Mayhew & Peterson, 1999; Micheli & Cagno, 2010; Morse et al., 2004; Sørensen et al., 2007; David Walters, 2006). These perceptions give rise to the first research hypothesis: **H1 - Employer's size (in terms of the number of people at his service, business volume, gross value added or share capital) or establishment's size (in terms of the average number of employees and/or other workers at site) are negatively correlated predictors of the total number of work-related accidents in the respective establishments.**

Furthermore, it's common to assign to the economic activity sectors that have a greater absolute or relative frequency of work-related accidents, or the highest incidence rates, a higher propensity or probability of work-related accidents occurrence. This is the case of the successive PNSPOSH (Portuguese Government, 2008d, 2015e), which provides that prevention should be aimed at the economic activity sectors that have been presenting the highest work-related accidents absolute frequency (such as manufacturing, wholesale and retail trade, construction, administrative activities and support services, transportation, human health activities and social support, accommodation, catering and similar, agriculture and fishing). These economic activity sectors are roughly the ones that presented, in 2014, the highest number of work-related accidents in Portugal (Eurostat, 2016; GEP, 2016): manufacturing (about 27% of the total number of work-related accidents); wholesale and retail trade, and construction (both with about 15%); administrative and support service activities (7%); transportation and storage, human health and social work activities, and accommodation and food service activities (all representing about 6%); and agriculture, forestry and fishing (5%). Similarly, Jacinto et al.(2007), in their research on the determinants of work-related accidents in the economic activity sectors with higher density of workers and incidence rates of work-related accidents, concluded that there is a higher probability of occurrence of work-related accidents in companies that operate in certain economic activity sectors (e.g. extractive industry, basic metallurgy and metal products and construction), whereas the workers most likely to be victims of fatal work-related accidents are the ones working in mining and quarrying. These evidences suggest the following research hypothesis: **H2 - The main economic activity sector of a given establishment explains its total number of work-related accidents.**

The reviewed literature also revealed the existence of several OSHMS effectiveness critical success factors, specific related to OSHMS components. They include, for instance, the formulation and implementation of OSH policies, strategies and programs (Ramli et al., 2011), such as occupational risk prevention programs and health promotion programs (Gallagher et al., 2001; Redinger & Levine, 1998), which constitute mandatory practices in Portugal, as provided for in the Law No. 102/2009. In this perspective, the following research hypothesis is placed: **H3 - The organization of occupational risk prevention programs and health promotion programs in a given establishment contributes, *ceteris paribus*, to the decrease of the total number of work-related accidents in that establishment.**

Other OSHMS components, that the reviewed literature deemed to be OSHMS effectiveness critical success factors, involve the development of several OSH practices and actions, such as workers' consultation, participation (Gallagher et al., 2001; Ramli et al., 2011; Yorio & Wachter, 2014), training and information activities (Gallagher et al., 2001; Ramli et al., 2011; Yorio & Wachter, 2014) as well as the development of specific safety activities (Varonen & Mattila, 2002). Moreover, the literature review carried out also highlighted the most common barriers to OSHMS effectiveness in preventing work-related accidents - here understood as OSHMS ineffectiveness predictors. These critical unsuccess factors include, for example, the lack of access by workers to relevant information (Hasle, Limborg, et al., 2012; Olsen et al., 2010), the insufficient or inadequate training provided to workers and managers (Hasle, Limborg, et al., 2012; Legg et al., 2015; Olsen et al., 2010; Spangenberg et al., 2003) and the lack of worker's consultation and involvement (Gallagher et al., 2001; Hasle, Limborg, et al., 2012; Olsen et al., 2010; Yorio & Wachter, 2014) in OSH practices. The aforementioned findings allow inferring the following research hypotheses: **H4 - *Ceteris paribus*, the higher the percentage of workers in a given establishment that had been involved in OSH practices and actions (e.g. training, information, consultation, health promotion and health exams) the lower will be the total number of work-related accidents occurring in that establishment; H5 - *Ceteris paribus*, the higher the number of workers involved in the activities of the emergency internal structure for first aid, fire-fighting and evacuation of premises of a given establishment, the lower the total number of work-related accidents occurring in that establishment.**

Moreover, the reviewed literature suggests that the OSHMS ineffectiveness in preventing work-related accidents can also be explained by the use of outsourced (external)

OSH services to the detriment of in-house (internal) services (COWI, 2015). As such, the Portuguese legislator has chosen to establish, as a rule, in the legal framework for the promotion of safety and health at work, the mandatory adoption by employers of internal OSH services (Portuguese Parliament, 2009a:article 78), while allowing some exceptions (Portuguese Parliament, 2009a:article 80). The exemption from the use of OSH internal services has to be requested to and granted by ACT, upon the verification if the requirements for its derogation are met (e.g. do not performe high risk activities, present incidence rates of work-related accidents lower than the average of its sector in the past two years, did not recorded occupational diseases, has not been punished for very serious offences to OSH regulations in the last two years and did not violate the exposure limit values for substances or risk factors). The previous understandings underpin the following hypothesis: **H6 - The organization modality (e.g. internal, shared or external) of the OSH services implemented in a given establishment, explain the total number of work-related accidents occurring in that establishment.**

Critical OSHMS unsuccess factors also comprise the use of workers typically excluded from these systems, which tends to compromise OSHMS effectiveness, such as the self-employed workers (Gallagher & Underhill, 2012; Gallagher et al., 2001), sub-contracted companies workers (Gallagher & Underhill, 2012; Gallagher et al., 2001; Nenonen, 2011; Quinlan et al., 2009, 2001; Rebitzer, 1995) and temporary workers (David, Cloutier, & Ledoux, 2011; Gallagher & Underhill, 2012; Gallagher et al., 2001; Lippel et al., 2011; Quinlan & Mayhew, 2000; Underhill & Quinlan, 2011). The latter supports the following hypothesis: **H7 - The number of temporary workers in a user company explain the total number of work-related accidents in its establishments, that is, *ceteris paribus*, the greater the number of temporary workers in a user company, the higher the total number of work-related accidents in its establishments.**

Furthermore, Quinlan and Mayhew (2000) noted that the current trend towards the globalization of business and flexibilization of the workforce is driving the decline in the level of unionization of workers, thus limiting OSHMS effectiveness in preventing the occurrence of work-related accidents. In this conection, several researchers support the existence of a strong association between the presence of structures of collective representation of workers in the workplace and the reduction of work-related accidents incidence rates (Arocena & Nuñez, 2010; Johnstone et al., 2005; David Walters & Nichols, 2007), while Frick (2011) recognizes that OSHMS requires both worker influ-

ence and management commitment to reduce risks at work and that the influence through union backed safety representatives achieves the best OHS results. These theses led to the formulation of the following hypothesis: **H8 - The increase in the number of employer's unionized workers contributes, *ceteris paribus*, to the decrease in the total number of work-related accidents in its establishments.**

Other common barriers to OSHMS effectiveness in preventing work-related accidents include the workers' exposure to working conditions characterized by an excessive number of working hours, lack of rest and consequent fatigue and stress (Lilley et al., 2002), to dangerous substances or situations (Micheli & Cagno, 2010; Sørensen et al., 2007) and, in general, to high levels of occupational risks (Kirschenbaum et al., 2000; Rommel et al., 2016), as well as to manual handling of heavy loads, especially with inadequate postures or under pressure (Rommel et al., 2016). These considerations justify the following research hypotheses: **H9 - The total number of work-related accidents at a given establishment is, *ceteris paribus*, the greater the higher is the number of hours actually worked by the employer employees in that establishment;** **H10 - The establishments that expose their workers to a greater number of different risk factors present, *ceteris paribus*, a higher total number of work-related accidents;** and **H11 - The establishments that present a higher level of risk factors coverage by risk prevention measures show, *ceteris paribus*, a smaller total number of work-related accidents.**

4.5 Methodology

4.5.1 Collection and preliminary treatment of the data

The data used in the research on this topic, was collected by the GEP and provided by the ACT, and consists of the information supplied by the employers, by completing the electronic forms 'Annex Zero' and 'Annex D' of the Annual Single Report on OSH Service Activities (cf. Annexes 1 and 2), within the framework of the fulfilment of their legal obligation to provide annual information on the social activity of the company. This obligations are foreseen in paragraphs 1 and 2 of article 32 of the Law No. 105/2009, of 14 September (Portuguese Parliament, 2009b) regulating and amending the Portuguese Labour Code (Portuguese Parliament, 2009d) and in article 112 of the Law No. 102/2009 (Portuguese Parliament, 2009a). The term of presentation and con-

tent of such reports are regulated by the Ministerial Ordinance No. 55/2010, of 21 January (Portuguese Government, 2010) as amended by Ministerial Ordinance No. 108-A/2011, of 14 March (Portuguese Government, 2011).

It concerns the information for the year 2014, provided by 327,505 employers until 11 January 2016, with respect to all of its 337,230 establishments, located in Portugal.

Considering the research purpose, and his special focus on the establishments that, in spite of having OSH services organized, recorded fatal work-related accidents in 2014, some establishments were successively eliminated from the database: 44,989 which did not have workers in 2014; 266,899 with no record of work-related accidents in 2014; 25,238 without fatal work-related accidents in 2014; 2 with no occupational safety services organized; 3 with no occupational health services organized; and 1 that didn't fill out the 2014 'Annex Zero' form (cf. Annex 1).

After the elimination of the observations above, and taking into account the hypotheses to be tested, the data regarding the remaining establishments were subsequently subjected to additional treatment, involving the elimination of irrelevant variables and the creation of some additional qualitative and quantitative variables, on the basis of the original ones.

Once completed its preliminary treatment, the data was imported by the econometric EViews7 software, Version 7.1, Enterprise Edition, in order to carry out its confirmatory analysis.

4.5.2 Population and sample

The population to study consists of the establishments based in Portugal which, in spite of having OSH services organized, recorded fatal work-related accidents during the year 2014.

The convenience sample used consists of 98 establishments (of 95 employers) with OSH services organized, in which fatal work-related accidents occurred in 2014 (cf. Appendix 3). Overall, the 98 sample establishments registered, in 2014, a total of 1,824 work-related accidents, of which 1,709 non-fatal work-related accidents (irrespective of the resulting number of days of absence from work) and 115 fatal work-related accidents.

The sample data represents, according to GEP (2016), about 79% of the 145 (including 4 in the autonomous region of Madeira and 3 in Azores, although excluding the 15

registered abroad) fatal work-related accidents registered in Portugal in 2014 and around 1% of the 199,332 (including 3,543 in Madeira, 2,198 in Azores and excluding 4,056 registered abroad) non-fatal work-related accidents occurring in Portugal during that year (irrespective of the resulting number of days of absence from work).

4.5.3 Variables to be considered

The selection of the dependent variable and the independent variables initially considered in this research was guided mainly by its presumed contribution to the achievement of the primary goal of the research, taking into account the literature review and the subsequent definition of the research hypotheses.

The choice of the initially considered independent variables also resulted from the search, within the data provided by the abovementioned electronic forms ‘Annex Zero’ and ‘Annex D’, of the variables more likely to describe the PMOSHMS and its components, as well as to characterize the workers, the employers, the establishments and the context in which the activity is developed.

For convenience, the description of the dependent variable and the initially considered independent variables is made in the following Table 8. Besides the name, description, type and values possible to be assumed by each variable, Table 8 also indicates the underlying hypothesis as well as the respective PMOSHMS component (with reference to its code in Table 7). In addition, it also identifies the respective data source electronic form, followed by its specific source question.

4.5.4 Data analysis method

The data analysis method used is the multiple linear regression. In addition to its frequent use in the fields of Economics and Management, it has also been adopted in a number of researches on OSH (Barling et al., 2003; Mearns et al., 2001; G. S. Smith et al., 2006).

The method of least squares with the White heteroskedasticity correction was adopted to estimate the model parameters. The option for the use of the White heteroskedasticity correction was based on the expected data heteroskedasticity, considering that the sample includes establishments of very different sizes, therefore presenting a very high variability of the dependent variable (it assumes values between 1 and 231, showing a mean value of 18.61, with a standard deviation of 41.45 and a coefficient of variation of 2.23), as can be seen in Appendix 4.

No.	Name	Description	Type	Values	Hypotheses	OSHMS components codes ^a	Form source questions (annex-section-number)
DEPENDENT VARIABLE							
1	TWRA	Total number of work-related accidents (fatal and non-fatal) occurring in the establishments, suffered by workers (of the employer and of other employers, including temporary workers and self-employed).	Quantitative	Between 1 and 231	H1 to H11		AnnexD-V-1.1.1+2.1.1
INDEPENDENT VARIABLES							
‘ANNEX ZERO’ OF THE ANNUAL SINGLE REPORT ON OSH SERVICE ACTIVITIES							
GENERAL DATA ON THE EMPLOYERS							
2	EMPERSER	Total number of persons at the service of the employer at year's end.	Quantitative	Between 0 and 2,890	H1		AnnexZero-III-1
3	EMUNIWRK	Number of employer's unionized workers by the end of October.	Quantitative	Between 0 and 2,374	H8		AnnexZero-IV-1
4	EMTEMP	Number of temporary workers at the service of the employer (as user) at year's end.	Quantitative	Between 0 and 148	H7		AnnexZero-VI-1.2
5	EMBV	Employer's business volume.	Quantitative	Between € 0 and € 3,160,000,000	H1		AnnexZero-VIII-1
6	EMSC	Employer's share capital.	Quantitative	Between € 0 and € 1,260,000,000	H1		AnnexZero-VIII-2
7	EMNSC	Percentage of employer's share capital held by national entities.	Quantitative	Between 0 and 100			AnnexZero-VIII-2.1
8	EMFSC	Percentage of employer's share capital held by foreign entities.	Quantitative	Between 0 and 100			AnnexZero-VIII-2.2
9	EMCVT	Employer's costs with vocational training.	Quantitative	Between € 0 and € 31,824,720			AnnexZero-VIII-3.3
10	EMCOSHMH	Employer's total costs with OSH management.	Quantitative	Between € 0 and € 11,230,518			AnnexZero-VIII-4.6
11	EMGVA	Gross value added of the employer.	Quantitative	Between € 0 and € 835,000,000	H1		AnnexZero-IX-1
12	EMCPEH	Employer's total costs with personnel.	Quantitative	Between € 0 and € 65,653,790			AnnexZero-IX-1.1
13	EMNP	Employer's net profit.	Quantitative	Between € -2,214,074 and € 248,000,000			AnnexZero-IX-1.6
14	EMMAXWKHR	Maximum annual potential workable hours (within the normal working period of working days) for people at the service of the employer.	Quantitative	Between 0 and 5,337,674			AnnexZero-IX-3
15	EMHRPABS	Number of hours of paid absence to work.	Quantitative	Between 0 and 248,326			AnnexZero-IX-4.2
16	EMHRNPABS	Number of hours of non-paid absence to work.	Quantitative	Between 0 and 459,824			AnnexZero-IX-4.4
‘ANNEX D’ OF THE ANNUAL SINGLE REPORT ON OSH SERVICE ACTIVITIES							
GENERAL DATA ON THE ESTABLISHMENTS							
17	ESACSE	Main economic activity sector of the establishment - with reference to the aggregation of the sections of the Portuguese Economic Activities Classification (PEAC) in Primary Sector, Secondary Sector or Tertiary Sector. For the purpose of analysis, this variable was recoded through the following two dummy variables (see below): ESPRSE (Establishment of the Primary Sector - 17.1) and ESSESE (Establishment of the Secondary Sector - 17.2). The ESTESE (Establishment of the Tertiary Sector - 17.3) variable was considered the reference category because it is the ESACSE variable category with the lowest individual explanatory power over the dependent variable. As such, it was not included in the model.	Qualitative with 3 categories	Primary Sector (establishments with PEAC sections A - Agriculture, production of animals, hunting, forestry and fishing or B - Extractive industries); Secondary Sector (establishments with PEAC sections C - Manufacturing or F - Construction); or Tertiary Sector (establishments with PEAC sections D - Electricity, gas, steam, hot and cold water and cold air; E - Collection, treatment and distribution of water, sewerage, waste management and remediation activities; G - Wholesale and retail trade; H - Transport and storage; J - Information and communication activities; N - Administrative activities and support services; P - Education; or Q - Human health activities and social support).	H2		AnnexD-I-2
17.1	ESPRSE	Establishment of the Primary Sector (PEAC sections A or B).	Dummy	Assumes the value 1 when the establishment belongs to the Primary Sector (i.e., with PEAC section A or B); and the value 0 otherwise.	H2		AnnexD-I-2
17.2	ESSESE	Establishment of the Secondary Sector (PEAC sections C or F).	Dummy	Assumes the value 1 when the establishment belongs to the Secondary Sector (i.e., with PEAC section C or F); and the value 0 otherwise.	H2		AnnexD-I-2
17.3	ESTESE	Establishment of the Tertiary Sector (PEAC sections D, E, G, H, J, N, P or Q). Being considered as the reference category, it was not included in the model.	Dummy - reference category	Assumes the value 1 when the establishment belongs to the Tertiary Sector (i.e., with PEAC section D, E, G, H, J, N, P or Q); and the value 0 otherwise.	H2		AnnexD-I-2
18	ESAVEE	Average number of the employer employees assigned to the establishment.	Quantitative	Between 1 and 7,715	H1+H4		AnnexD-I-3.1

No.	Name	Description	Type	Values	Hypotheses	OSHMS components codes ^a	Form source questions (annex-section-number)
19	ESAVOTWRK	Average number of other workers (of other employers, including temporary workers and self-employed) that worked in the establishment.	Quantitative	Between 0 and 3,320	H1+H4		AnnexD-I-3.2
20	ESAVPERSER	Average number of persons who served in the establishment.	Quantitative	Between 1 and 8,215	H1+H4		AnnexD-I-3.3
21	ESHRWRK	Number of hours actually worked (including overtime) in the establishment by the employer employees.	Quantitative	Between 520 and 4,858,756	H9		AnnexD-I.4
SPECIFIC DATA ON ESTABLISHMENTS' OSHMS COMPONENTS							
22	ESORMOSAF	Establishment's occupational safety services organization modality. For the purpose of analysis, this variable was recoded through the following two dummy variables (see below): ESSAFINT (Establishment with internal occupational safety services - 22.1) and ESSAFEXT (Establishment with external occupational safety services - 22.2). The variable ESSAFSHA (Establishment with shared occupational safety services - 22.3) was considered the reference category because it is the ESORMOSAF variable category with the lowest individual explanatory power for the dependent variable. As such, it was not included in the model.	Qualitative with 3 categories	Internal Services; Shared Services; or External Services.	H6	2.1+2.2	AnnexD-II-5.1
22.1	ESSAFINT	Establishment with internal occupational safety services.	Dummy	Assumes the value 1 when the establishment has internal occupational safety services; and the value 0 otherwise.	H6	2.1+2.2	AnnexD-II-5.1.1
22.2	ESSAFEXT	Establishment with external occupational safety services.	Dummy	Assumes the value 1 when the establishment has external occupational safety services; and the value 0 otherwise.	H6	2.1+2.2	AnnexD-II-5.1.3
22.3	ESSAFSHA	Establishment with shared occupational safety services. Being considered as the reference category, it was not included in the model.	Dummy - reference category	Assumes the value 1 when the establishment has shared occupational safety services; and the value 0 otherwise.	H6	2.1+2.2	AnnexD-II-5.1.2
23	ESORMOHEA	Establishment's occupational health services organization modality. For the purpose of analysis, this variable was recoded through the following two dummy variables (see below): ESHEAINT (Establishment with internal occupational health services - 23.1) and ESHEAEXT (Establishment with external occupational health services - 23.2). The variable ESHEASHA (Establishment with shared occupational health services - 23.3) was considered the reference category because it is the ESORMOHEA variable category with the lowest individual explanatory power for the dependent variable. As such, it was not included in the model.	Qualitative with 3 categories	Internal Services; Shared Services; or External Services.	H6	2.1+2.2	AnnexD-II-5.2
23.1	ESHEAINT	Establishment with internal occupational health services.	Dummy	Assumes the value 1 when the establishment has internal occupational health services; and the value 0 otherwise.	H6	2.1+2.2	AnnexD-II-5.2.1
23.2	ESHEAEXT	Establishment with external occupational health services.	Dummy	Assumes the value 1 when the establishment has external occupational health services; and the value 0 otherwise.	H6	2.1+2.2	AnnexD-II-5.2.3
23.3	ESHEASHA	Establishment with shared occupational health services. Being considered as the reference category, it was not included in the model.	Dummy - reference category	Assumes the value 1 when the establishment has shared occupational health services; and the value 0 otherwise.	H6	2.1+2.2	AnnexD-II-5.2.2
24	ESEMCYWRK	Number of workers assigned to the emergency internal structure for first aid, fire-fighting and evacuation of premises.	Quantitative	Between 0 and 48	H5	1.5+2.17	AnnexD-II-3
25	ESRSKPREV	Organization of occupational risk prevention programs in the establishment.	Dummy	Assumes the value 1 if the employer organizes occupational risk prevention programs; and the value 0 otherwise.	H3	1.4	AnnexD-IV-1.1
26	ESHEAPROM	Organization of health promotion programs in the establishment.	Dummy	Assumes the value 1 if the employer organizes health promotion programs; and the value 0 otherwise.	H3	2.16	AnnexD-IV-1.2
27	ESCOVINFOAC	Level of coverage of the information actions carried out in the establishment (number of informed workers / average number of employer employees and other workers that worked in the establishment).	Quantitative	Between 0 and 2	H4	1.6 +2.14+2.15+2.20	AnnexD-IV-4.1.1.2+I-3.2
28	ESCOVCONSAC	Level of coverage of the consultation actions carried out in the establishment (number of workers covered / average number of employer employees and other workers that worked in the establishment).	Quantitative	Between 0 and 1	H4	2.19	AnnexD-IV-4.2.1.2+I-3.2
29	ESCOVTRAIAC	Level of coverage of the training actions carried out in the establishment (number	Quantitative	Between 0 and 1	H4	1.7+2.21	AnnexD-IV-4.3.1.2+I-3.2

No.	Name	Description	Type	Values	Hypotheses	OSHMS components codes ^a	Form source questions (annex-section-number)
		of workers trained / average number of employer employees and other workers that worked in the establishment).					
30	ESCOVHEAPRAC	Level of coverage of health promotion actions carried out in the establishment (number of workers covered / average number of employer employees assigned to the establishment).	Quantitative	Between 0 and 6	H4	2.16	AnnexD-IV-6.4.2+I-3.1
31	ESPHYRSKFAC	Number of different physical risk factors identified in the establishment.	Quantitative	Between 0 and 200	H10+H11	2.3+2.4	AnnexD-IV-5.1.1
32	ESCHERSKFAC	Number of different chemical risk factors identified in the establishment.	Quantitative	Between 0 and 100	H10+H11	2.3+2.4	AnnexD-IV-5.2.2
33	ESBIORSKFAC	Number of different biological risk factors identified in the establishment.	Quantitative	Between 0 and 2	H10+H11	2.3+2.4	AnnexD-IV-5.3.1
34	ESMSDRSKFAC	Number of different musculoskeletal disorders (MSD) risk factors identified in the establishment.	Quantitative	Between 0 and 150	H10+H11	2.3+2.4	AnnexD-IV-5.4.1
35	ESPSYRSKFAC	Number of different psychosocial risk factors identified in the establishment.	Quantitative	Between 0 and 10	H10+H11	2.3+2.4	AnnexD-IV-5.5.1
36	ESOTHRSKFAC	Number of different other risk factors identified in the establishment.	Quantitative	Between 0 and 50	H10+H11	2.3+2.4	AnnexD-IV-5.6.1
37	ESPHYRSKMEA	Number of different physical risks prevention measures implemented in the establishment.	Quantitative	Between 0 and 51	H11	2.5+2.6 to 2.9+2.11 to 2.13	AnnexD-IV-5.1.4
38	ESCHERSKMEA	Number of different chemical risk prevention measures implemented in the establishment.	Quantitative	Between 0 and 120	H11	2.5+2.6 to 2.9+2.11 to 2.13	AnnexD-IV-5.2.6
39	ESBIORSKMEA	Number of different biological risk prevention measures implemented in the establishment.	Quantitative	Between 0 and 5	H11	2.5+2.6 to 2.9+2.11 to 2.13	AnnexD-IV-5.3.6
40	ESMSDRSKMEA	Number of different MSD risk prevention measures implemented in the establishment.	Quantitative	Between 0 and 30	H11	2.5+2.6 to 2.9+2.11 to 2.13	AnnexD-IV-5.4.4
41	ESPSYRSKMEA	Number of different psychosocial risks prevention measures implemented in the establishment.	Quantitative	Between 0 and 15	H11	2.5+2.6 to 2.13	AnnexD-IV-5.5.4
42	ESOTHRSKMEA	Number of different other professional risks prevention measures implemented in the establishment.	Quantitative	Between 0 and 82	H11	2.5+2.6 to 2.9+2.11 to 2.13	AnnexD-IV-5.6.4
43	ESTOTRSKMEA	Total number of different occupational risk prevention measures implemented in the establishment.	Quantitative	Between 0 and 145	H11	2.5+2.6 to 2.13	AnnexD-IV-5.1.4+5.2.6+5.3.6+5.4.4+5.4+5.6.4
44	ESCOVRSKMEA	Level of coverage of the occupational risk prevention measures implemented in the establishment (total number of different occupational risk prevention measures implemented / total number of different risk factors identified).	Quantitative	Between 0 and 6	H11	2.5+2.6 to 2.13	AnnexD-IV-5.1.1+5.2.2+5.3.1+5.4.1+5.5.1+5.6.1+5.1.4+5.2.6+5.3.6+5.4.4+5.5.4+5.6.4
45	ESCOVHEAEXA	Level of coverage of health examinations conducted for employer employees assigned to the establishment (number of health examinations conducted / average number of employer employees assigned to the establishment).	Quantitative	Between 0 and 4	H4	2.16	AnnexD-IV-6+6.1.1+6.1.2+6.1.3+I-3.1

Table 8 - Description of the dependent variable and the initially considered independent variables and its correspondence with the hypotheses to be tested, PMOSHMS components and ‘Annex Zero’ or ‘Annex D’ source questions

Source: Own elaboration, based on the provisions of article 112 of the Law No. 102/2009, of 10 September, articles 32 and 33 of the Law No. 105/2009, of 14 September and Ministerial Ordinances Nos. 55/2010, of 21 January and 108-A/2011, of 14 March (Portuguese Government, 2010, 2011, Portuguese Parliament, 2009a, 2009b).

Note: (a) with reference to its code in Table 7.

4.5.5 Selection process of the independent variables to be included in the model

The choice of the independent variables to be included in the multiple linear regression model (among the 50 variables initially considered and described above) resulted from a sequential selection process, based on two phases, whose results are exhibited in Appendix 5.

Initially, simple linear regressions of the dependent variable on each quantitative independent variable were carried out (see Appendix 6.1). Based on the results of these regressions, all variables with no individual statistically significant explanatory power (i.e., with associated parameter $p\text{-value} > \alpha = 0.05$) were excluded from future consideration (variables 2 to 5, 7, 8, 11, 13 to 15, 24, 32, 33, 35 to 38 and 40 to 43 of Table 8). In addition, a reference category for each qualitative variable was also left out of the model to avoid perfect multicollinearity (variables 17.3, 22.3 and 23.3 of Table 8).

The subsequent phase, exclusively focused on the remaining quantitative variables (which revealed to have statistically significant individual explanatory power in the previous phase), involved: firstly, the calculation of the correlation coefficients (r) in-between those quantitative independent variables and between each one of them and the dependent variable (cf. Appendix 6.2); secondly, the analysis of the correlation coefficients and successive exclusion, from further consideration, of the quantitative independent variables that showed serious collinearity (see Appendix 7). To this purpose, it was considered the existence of serious collinearity when the correlation coefficient between two variables was greater than the correlation coefficient of any of them with the dependent variable. When serious collinearity occurred between a pair of quantitative independent variables, the quantitative independent variable with the lowest correlation coefficient with the dependent variable was excluded.

As a result of this two-step selection process, only 12 variables (out of 50 included in Table 8) were selected for inclusion in the unrestricted multiple linear regression model, as shown in Appendix 5: ESPRSE (17.1), ESSESE (17.2), ESAVOTWRK (19), ESAVPERSER (20), ESSAFINT (22.1), ESSAFEXT (22.2), ESHEAINT (23.1), ESHEAEXT (23.2), ESRSKPREV (25), ESHEAPROM (26), ESCOVINFOAC (27) and ESPHYRSKFAC (31).

4.6 Results presentation

In view of the above process, the initial multiple linear regression model to estimate is the following:

$$\begin{aligned}
 Y_i = & \hat{\beta}_0 + \hat{\beta}_1(ESAVPERSER) + \hat{\beta}_2(ESSAFEXT) + \hat{\beta}_3(ESPHYRSKFAC) \\
 & + \hat{\beta}_4(ESSESE) + \hat{\beta}_5(ESSAFINT) + \hat{\beta}_6(ESRSKPREV) + \hat{\beta}_7(ESPRSE) \\
 & + \hat{\beta}_8(ESHEAPROM) + \hat{\beta}_9(ESHEAEXT) + \hat{\beta}_{10}(ESAVOTWRK) \\
 & + \hat{\beta}_{11}(ESCOVINFOAC) + \hat{\beta}_{12}(ESHEAINT) + \hat{\mu}_i
 \end{aligned} \tag{5}$$

The results of its estimation are displayed in the following Table 9:

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.091969	5.016550	0.217673	0.828200
ESAVPERSER	0.023856	0.004387	5.437954	0.000000
ESSAFEXT	9.790588	3.188249	3.070835	0.002900
ESPHYRSKFAC	0.459114	0.187907	2.443299	0.016600
ESSESE	8.106063	4.482060	1.808557	0.074100
ESSAFINT	-8.262467	4.988822	-1.656196	0.101400
ESRSKPREV	-5.308550	4.142264	-1.281558	0.203500
ESPRSE	2.804472	3.461039	0.810298	0.420000
ESHEAPROM	-3.197566	4.067471	-0.786131	0.434000
ESHEAEXT	1.489895	3.575760	0.416665	0.678000
ESAVOTWRK	0.007652	0.021190	0.361117	0.718900
ESCOVINFOAC	-1.034789	4.686930	-0.220782	0.825800
ESHEAINT	-0.021686	4.131617	-0.005249	0.995800
R^2_U				0.813596
Sum Squared Resid (SQR _U)				31,062.94

Table 9 - Unrestricted multiple linear regression model estimation results (by *p*-value ascending order)

Source: EViews 7 outputs of the unrestricted multiple linear regression model estimation results (cf. Appendix 6.3).

Note: The shaded in grey independent variables are not statistically significant (*p*-value > 0.05).

This model explains about 81.4% of the variability of the total number of work-related accidents occurring in the establishments (TWRA dependent variable).

It is noted that, at the conventional significance level of $\alpha = 0.05$, only 3 of the 12 independent variables are statistically significant: ESAVPERSER (associated parameter *p*-value = 0.000), ESSAFEXT (associated parameter *p* = 0.0029) and ESPHYRSKFAC (associated parameter *p* = 0.0166). The remaining 9 independent variables are not statistically significant, to the extent that their respective parameters feature *p*-values > 0.05.

In those circumstances, the parameters associated with those independent variables, at this level of significance, may not be significantly different from zero. However, it is important to be sure that the parameters associated with those variables can in fact be considered jointly (all) equal to zero. Indeed, the exclusion of some of those 9 inde-

pendent variables can make significant one (or more) of the remaining ones. For this purpose, and taking into account the ordering of the independent variables, according to the value assumed by the respective associated parameter *p-value*, the non-significant variables were successively removed from the model in ascending order of significance, until all restricted model parameters presented *p-values* all less than 0.05 (as shown in Appendices 6.4 and 6.5).

The results of this orderly and successive process of non-significant independent variables removal are exhibited in Table 10:

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.827801	2.489222	-1.939482	0.0555
ESAVPERSER	0.025439	0.005157	4.932954	0.0000
ESSAFEXT	12.381490	3.196669	3.873248	0.0002
ESPHYRSKFAC	0.525782	0.150563	3.492099	0.0007
ESSAFINT	-9.101567	2.613574	-3.482421	0.0008
ESSESE	7.737859	3.806042	2.033046	0.0449
R^2_R				0.803659
Sum Squared Resid (SQR _R)				32,718.88
F Test			$F = 0.647 < F_{(7,85)}^{0.05} = 2.119 ; p = 0.977$	
Ramsey RESET test			FITTED ² (<i>p-value</i> = 0.6998 > $\alpha = 0.05$)	

Table 10 - Results of the restricted multiple linear regression model estimation, exclusion restrictions test and Ramsey regression equation specification error test

Source: Own calculations and EViews 7 outputs for the restricted multiple linear regression model estimation results and Ramset RESET test results (see Appendices 6.5 and 6.6).

The analysis of Table 10 leads to the conclusion that, in addition to the 3 explanatory variables initially classified as significant, also the two variables ESSAFINT and ESSESE (before considered as non-significants) must belong to the restricted version of the model (now their associated parameters have *p-values* of, respectively, 0.0008 and 0.0449, both less than the conventional significance level of $\alpha = 0.05$). It also allows concluding that the restricted model still explains about 80.4% of the variability of the TWRA dependent variable.

In order to confirm this restricted version, a test against the original (unrestricted) version through an F test is also reported in Table 10. The result $F = 0.647 < F_{(7,85)}^{0.05} = 2.119 ; p \text{ value} = 0.977$ allows concluding that the joint hypothesis $H_0: \beta_6 = \beta_7 = \beta_8 = \beta_9 = \beta_{10} = \beta_{11} = \beta_{12} = 0$ is not rejected, because it has a high degree of credibility (*p-value* = 0.977, that is, the probability of rejecting this hypothesis when this hypothesis is true is much higher than the conventional value for this type of error (i.e., $\alpha = 0.05$), thus enabling the conclusion that the removed variables are not jointly significant, so the best model is the restricted version shown in Table 10.

The restricted model misspecification was also tested, through the Ramsey Regression Equation Specification Error Test (RESET), using the econometric program EViews 7. The result of the test is also reported in Table 10 (see also Appendix 6.6). In the light of such results, one may conclude that the variable $FITTED^2$ is not significant. Therefore, there is no evidence of misspecification (Ramsey, 1969).

According to the results of all this testing, the estimated restricted multiple linear regression model to adopt is:

$$Y_i = -4.827801 + 0.025439 * (ESAVPERSER) + 12.381490 * (ESSAFEXT) \\ + 0.525782 * (ESPHYRSKFAC) + 7.737859 * (ESSESE) \\ - 9.101567 * (ESSAFINT) + \hat{\mu}_i \quad (6)$$

4.7 Discussion of the results

The above presented results enable us to revisit the formulated research hypotheses, testing them and confronting them with the obtained results as well as discussing them in the light of the reviewed literature. In this perspective, the obtained results allow to demonstrate the following:

H1 - Employer's size (in terms of the number of people at his service, business volume, gross value added or share capital) or establishment's size (in terms of the average number of employees and/or other workers at site) are negatively correlated predictors of the total number of work-related accidents in the respective establishments, should be partially rejected. Indeed, this hypothesis is only true in relation to the explanatory power of the establishment's size measured in terms of the average number of persons (employees and workers of other employers, including subcontractors' workers, temporary workers and self-employed workers) who worked in it.

In fact:

1. The corresponding independent variable (ESAVPERSER) has statistically significant explanatory power for the total number of work-related accidents occurred in a given establishment ($p\text{-value} = 0.000$). However, the direction of its association with the dependent variable contradicts what the hypothesis states. Indeed, it demonstrates that the larger is the establishment, in terms of the average number of persons who work there, the more likely is the occurrence of a work-related accident. This finding, although regarding the size of the establishment, rather than

the size of the employer, seems consistent with the results of the preceding research, on fatal work-related accidents predictors, which indicate that the workers of large employers have a higher probability of being victims of fatal work-related accidents than the ones of the micro enterprises and SMEs. This result also appears to confirm the relevance of the size factor in the occurrence of work-related accidents (Legg et al., 2015; Micheli & Cagno, 2010; Sørensen et al., 2007). Nevertheless, it suggests that larger establishments in terms of their average number of workers (and not the smaller ones, more commonly associated to micro and SMEs) are the ones with higher propensity for showing work-related accidents occurrence. As discussed earlier, the latter contrast with the thesis that the SMEs have an increased risk of work-related accidents when compared to the larger ones (Baldock et al., 2006; Enrico Cagno et al., 2013, 2011; European Parliament, 2014; Gallagher et al., 2001; Hasle et al., 2009; Hasle, Kvorning, et al., 2012; Hasle & Limborg, 2006; Hasle, Limborg, et al., 2012; Laird et al., 2011; Legg et al., 2015; Mayhew & Peterson, 1999; Micheli & Cagno, 2010; Morse et al., 2004; Okun et al., 2001; Portuguese Government, 2008d, 2015e; Sørensen et al., 2007; Stevens, 1999; Targoutzidis et al., 2014; David Walters, 2006). This finding, moreover, in spite of referring to the establishment's size (rather to the employer's size), appears to contradict the Portuguese descriptive statistics on fatal accidents at work, which seems to indicate that the larger the employers' size the lower is expected to be the number of work-related accidents (Eurostat, 2016; GEP, 2016), as well as both the successive PNSPOSH (Portuguese Government, 2008d, 2015e), which understand micro enterprises and SMEs as being 'risk companies' and the concerns of the European Commission (European Commission, 2014), regarding the SMEs difficulties in complying with the labour and OSH regulations. The possible reasons underlying the higher probability of work-related accidents occurrence in larger establishments, rather than in smaller ones, can eventually be explained, as already mentioned, by the fact that the former are usually the ones with more workers at his service and, consequently, the ones that expose a higher number of workers to a wider range and number of different occupational risks factors. Other possible explanation might be the underreporting of work-related accidents by the smaller establishments, as suggested by several researchers, regarding the employers' size effect on the occurrence of work-related accidents (Legg et al., 2015; Morse et al., 2004; Sørensen et al., 2007; Stevens, 1999).

2. Regarding the establishment's size measured by the average number of other workers (workers of other employers, including temporary workers and self-employed), the results show that the correspondent ESAVOTWRK variable has no explanatory power for the work-related accidents occurring in the establishments. Indeed, and despite having been initially included in the unrestricted multiple linear regression model, this variable revealed to be statistically non-significant to explain TWRA dependent variable, having been left out of its restricted version (cf. Appendices 5 and 6.3 to 6.5). This finding seems to contradict the thesis that the use of self-employed workers, subcontracted companies workers and temporary workers tends to induce an increase in the incidence rates of work-related accidents, as defended by several researchers (David et al., 2011; Gallagher & Underhill, 2012; Gallagher et al., 2001; Lippel et al., 2011; Nenonen, 2011; Quinlan et al., 2009, 2001; Quinlan & Mayhew, 2000; Rebitzer, 1995; Underhill & Quinlan, 2011).
3. With regard to the impact on the total number of work-related accidents occurring in the establishments of the average number of employees of the responsible for the establishment that worked there, the conclusions that could be withdrawn were undermined by the existence of serious collinearity between the corresponding independent variable (ESAVEE) and the ESAVPERSER independent variable, which dictated the non-inclusion of the former in the model (see Appendices 5 and 7).
4. Moreover, aside from the fact that the independent variables EMPERSER, EMGVA and EMBV (corresponding to the size of the employer in terms of, respectively, the number of persons at his service, gross value added and business volume) present an unexpected positive correlation with the dependent variable, they do not have statistically significant individual explanatory power for the total number of work-related accidents occurring in an establishment (at the usual level of significance of $\alpha = 0.05$). In fact, their respective *p-values* are, respectively, 0.0677, 0.2273 and 0.5134 (all of them higher than $\alpha = 0.05$), as shown in the Appendices 5 and 6.1. Furthermore, the circumstance that the size of the employer (in terms of the number of persons at his service, gross value added and business volume) do not explain the total number of work-related accidents in a given establishment, appears to contradict the thesis, mentioned above, which holds that size is a relevant factor in the management of safety and health at work, with ex-

planatory power for work-related accidents occurrence (Micheli & Cagno, 2010; Sørensen et al., 2007).

5. With regard to the impact of employer's size (measured in terms of its amount of share capital) in the total number of establishment's work-related accidents, the conclusions that could be withdrawn were compromised by the existence of serious collinearity between the corresponding independent variable (EMSC) and the ESAVPERSER independent variable, which dictated the non-inclusion of the EMSC variable in the model (cf. Appendices 5 and 7).

The above mixed and apparent contradictory results, concerning the associations between the occurrence of work-related accidents and the size of both the employer and the establishments, seems to suggest the need for further research on these particular associations.

H2 - The main economic activity sector of a given establishment explains its total number of work-related accidents, must not be rejected. In fact, the main economic activity sector of the establishment has statistically significant explanatory power for the total number of work-related accidents registered in an establishment. Actually, and having been initially included in the unrestricted multiple linear regression model two (ESPRSE e ESSESE) of the three dummy categories of the ESACSE qualitative variable, ESSESE (i.e., establishments of the secondary sector, which includes manufacturing and construction) revealed to be statistically significant to explain TWRA dependent variable, having therefore stayed in the restricted version of the multiple linear regression model. This result is consistent with the findings of the following research on the labour inspectorates' performance assessment, which suggest that the areas of jurisdiction of the effective local branches of the ACT employ, on average, a lower volume of workers in the economic activity sectors that usually expose workers to higher levels of occupational risks (and which, therefore, typically present higher incidence rates of accidents at work) than the one employed in the areas of jurisdiction of the ineffective local branches. Although the non-rejection of the aforementioned hypothesis refers specifically to the main economic activity sector of the establishment (not to the economic activity sector of the employer, which, as already pointed out, may be quite different from the one of the employer), this result seems consistent, however, with the thesis of Jacinto et al. (2007), according to which there is a higher probability of occurrence of work-related accidents in employers of certain economic activity sectors. It also appears in line with the Portuguese descriptive statistics on accidents at work, regarding the ac-

tivity sectors which present higher numbers of work-related accidents (Eurostat, 2016; GEP, 2016) and with the resulting priorities of the successive PNSPOSH (2008d, 2015e). Notwithstanding the above, and even though referring to establishments' economic sector (instead of employers' economic sector), this finding seems to contradict the results of the preceding research, on the predictors of fatal work-related accidents, whose results indicate that the employers' economic activity sector do not have statistically significant explanatory power for the occurrence of fatal work-related accidents. In the light of the above mixed and apparently contradictory results, concerning the association between the occurrence of work-related accidents and the economic activity sector of both the employers and the establishments, it seems reasonable to assume the need for deepen the research on the effects of the economic activity sectors of both the establishments and the employers on the work-related accidents.

H3 - The organization of occupational risk prevention programs and health promotion programs in a given establishment contributes, *ceteris paribus*, to the decrease of the total number of work-related accidents in that establishment, must be rejected. Indeed, and although there is a negative correlation between the organization of health promotion programs and occupational risk prevention programs in the establishments and the total number of work-related accidents occurring in such establishments, as expected, neither one nor the other have statistically significant explanatory power for the occurrence of work-related accidents in a given establishment. In fact, and despite the ESRSKPREV and ESHEAPROM independent variables have been initially included in the unrestricted multiple linear regression model, they were left out of its restricted version. The finding that the organization of health promotion programs has no statistically significant explanatory power for the occurrence of work-related accidents contradicts the conclusions of the research carried out by Ramli et al. (2011) and puts into question the effectiveness of the formulation and implementation of occupational health promotion programs in the prevention of work-related accidents, as laid down in the universal OSHMS model proposed by Redinger & Levine (1998), envisaged by points g), l) and m) of paragraph 1 of Article 73-B of the Law No. 102/2009 and embodied in the PMOSHMS (see components 1.6 and 2.16 of Table 7). Moreover, the lack of statistically significant explanatory power for the occurrence of work-related accidents of the organization of occupational risk prevention programs refutes the previous mentioned findings of several other researches (Gallagher et al., 2001; Ramli et al., 2011). It also puts into question the legal obligation, imposed to all employers in

Portugal, to organise and implement risk prevention programs, as provided for in points c) and o) of paragraph 1 of Article 73-B of the Law No. 102/2009 and, by extension, in the PMOSHMS (cf. components 1.4 and 2.6 in Table 7). In this context, more than contradicting the abovementioned theses, regarding the relevance and effectiveness of the organization of health promotion programs and occupational risk prevention programs in the prevention of work-related accidents, these findings raise serious doubts about the quality and suitability of the health promotion and risk prevention programs implemented in the Portuguese establishments where fatal work-related accidents occurred.

H4 - *Ceteris paribus*, the higher the percentage of workers in a given establishment that had been involved in OSH practices and actions (e.g. training, information, consultation, health promotion and health exams) the lower will be the total number of work-related accidents occurring in that establishment, must be partially rejected, for the following reasons:

1. As for the impact of the level of coverage of the information actions carried out in an establishment on its total number of work-related accidents - there is a negative correlation between the correspondent variable ESCOVINFOAC and the dependent variable. This finding is in line with the generally accepted thesis that providing information on OSH to workers contribute to the improvement of OSHMS effectiveness in the prevention of work-related accidents (Hasle, Limborg, et al., 2012; Olsen et al., 2010; Yorio & Wachter, 2014). This thesis, by the way, also justifies the consecration of the legal obligation of all employers in Portugal to ensure this type of information to workers (as provided, for example, in articles 15, 19, 24, 43, 73-B, 102 and 106 of the Portuguese Law No 102/2009), as well as on the PMOSHMS (cf. components 1.6, 2.1 and 2.20 in Table 7). Notwithstanding the above, the results indicate that ESCOVINFOAC independent variable has no explanatory power, with statistical significance, for the dependent variable. In fact, although ESCOVINFOAC has been initially included in model, she does not appear in its restricted version. This finding raises serious concerns about the quality and adequacy of the OSH information given to workers in establishments where fatal work-related accidents occurred.
2. With regard to the impact of the percentage of workers in a given establishment that were object of training, consultation and health promotion actions on the total number of work-related accidents occurring in it - the conclusions that could be withdrawn were harmed by the serious collinearity between the corresponding var-

iables (ESCOVTRAIAC, ESCOVCONSAC and ESCOVHEAPRAC, respectively) and the ESCOVINFOAC quantitative independent variable. The latter dictated the non-inclusion of the aforementioned variables in the model (as shown in Appendices 5 and 7). The same applies to the percentage of workers of a given establishment that were object of health exams, as the corresponding ESCOVHEAEXA quantitative variable was excluded due to its serious collinearity with the ESPHYRSKFAC variable.

H5 - *Ceteris paribus*, the higher the number of workers involved in the activities of the emergency internal structure for first aid, fire-fighting and evacuation of premises of a given establishment, the lower the total number of work-related accidents occurring in that establishment, should be rejected. In fact, besides the unexpected positive correlation between the number of workers assigned to the emergency internal structure for first aid, fire-fighting and evacuation of premises and the total number of work-related accidents occurring in the establishments, the ESEMCYWRK variable showed no statistically significant individual explanatory power for the dependent variable, to the extent that the respective *p-value* = 0.1234 (cf. Appendices 5 and 6.1). This result contradicts the relevance of the emergency preparedness and response system to OSHMS effectiveness in preventing work-related accidents, as supported by several researchers (Gallagher et al., 2001; Redinger & Levine, 1998). It also calls into question the understanding underlying the employer's legal obligation to ensure the existence and operation, in every establishments, of an emergency internal structure for first aid, fire-fighting and evacuation of premises (as foreseen in paragraph 9 of article 15, point i) of paragraph 1 of article 73-B and article 75 of the Portuguese Law N.º 102/2009) and, consequently, on the PMOSHMS (cf. components 1.5 and 2.17 in Table 7). The rejection of this hypothesis suggests the inefficiency and inadequacy of the emergency internal structures of the Portuguese establishments where fatal work-related accidents occurred. The inadequacy and lack of effectiveness of these emergency internal structures, on the other hand, can be possibly explained for several reasons, including the way they are organized, the use of inappropriate equipment, and/or the unsuitability of the qualifications, training and skills of the workers assigned to it.

H6 - The organization modality (e.g. internal, shared or external) of the OSH services implemented in a given establishment, explain the total number of work-related accidents occurring in that establishment, must be partially rejected. It

should not be rejected in what concerns the organization modality of the occupational safety services implemented in the establishments. In fact, both the ESSAFINT and ESSAFEXT dummy categories (of the ESORMOSAF qualitative variable) have statistically significant explanatory power for the total number of work-related accidents registered in a given establishment, as shown in the restricted version of the model. Moreover, the negative correlation shown by ESSAFINT and the positive correlation shown by ESSAFEXT are also consistent with the reviewed literature. Indeed, these findings are consistent with the understanding that employers should give priority to the implementation of internal OSH services rather than external services, as advocated by the COWI (2015) and provided for in Portuguese Parliament (2009a:article 78).

However, H6 should be rejected in what refers to the organization modality of the occupational health services implemented in the establishments, because it has no statistically significant explanatory power regarding the total number of work-related accidents occurring in a given establishment. In fact, and although the ESHEAINT and ESHEAEXT dummy categories (of the ESORMOHEA qualitative variable) were initially included in the unrestricted model, none of them appear in its restricted version. Moreover, the lack of statistically significant explanatory power for the occurrence of work-related accidents shown by the organization modality of the occupational health services implemented in the establishments, might eventually suggest that this variable is somewhat more suitable to explain the number of registered occupational diseases than the number of work-related accidents occurred.

H7 - The number of temporary workers in a user company explain the total number of work-related accidents in its establishments, that is, *ceteris paribus*, the greater the number of temporary workers in a user company, the higher the total number of work-related accidents in its establishments, should be rejected. Indeed, and despite the correspondent EMTEMP independent variable has presented a positive correlation with the dependent variable, as would be expected (David et al., 2011; Gallagher et al., 2001; Johnstone & Quinlan, 2006; Lippel et al., 2011; Underhill & Quinlan, 2011), she has no statistically significant individual explanatory power for the dependent variable, since the respective $p\text{-value} = 0.051 > \alpha = 0.05$ (cf. Appendices 5 and 6.1).

H8 - The increase in the number of employer's unionized workers contributes, *ceteris paribus*, to the decrease in the total number of work-related accidents in its establishments, must be rejected. In fact, and in addition to the fact that the correspond-

ing EMUNIWRK independent variable has revealed an unexpected positive correlation with the dependent variable, in contrast to what is advocated by several researchers (Arocena & Nuñez, 2010; Johnstone et al., 2005; Quinlan & Mayhew, 2000; David Walters & Nichols, 2007), she has no statistically significant individual explanatory power for the dependent variable, to the extent that its respective $p\text{-value} = 0.4853$ (cf. Appendices 5 and 6.1).

H9 - The total number of work-related accidents at a given establishment is, *ceteris paribus*, the greater the higher is the number of hours actually worked by the employer employees in that establishment. The conclusions that could be taken from this hypothesis testing were hindered by the serious collinearity between the corresponding ESHRWK quantitative variable and the ESAVPERSER quantitative independent variable, which dictated the non-inclusion of the former in the unrestricted model (see Appendices 5 and 7). Nevertheless, ESHRWK revealed to have a statistically significant individual explanatory power for the dependent variable ($p\text{-value} = 0.0000$) and showed a positive correlation with the dependent variable, as it would be expected.

H10 - The establishments that expose their workers to a greater number of different risk factors present, *ceteris paribus*, a higher total number of work-related accidents, should be partially rejected. In fact, this hypothesis is only true for the exposure of the workers to physical risk factors (e.g. noise, vibrations, ionizing radiation, non-ionizing radiation, lighting, thermal environment, use of machinery and work equipment and other physical agents).

Indeed, the number of different physical risk factors to which the workers are exposed in the establishments (ESPHYRSKFAC variable) has statistically significant explanatory power for the total number of work-related accidents occurred in a given establishment ($p\text{-value} = 0.0007$), as shown in Table 10 and Appendices 5 and 6.5. Moreover, the ESPHYRSKFAC variable is also positively correlated with the dependent, as stated in the respective hypothesis. The verification of this hypothesis is consistent with the conclusions of several researchers (Kirschenbaum et al., 2000; Rommel et al., 2016) about the impact of dangerous situations and high levels of occupational risks on the occurrence of work-related accidents.

Furthermore, the number of different chemical, psychosocial, biological and other risk factors to which the workers are exposed in the establishments (corresponding, respectively, to the independent variables ESCHERSKFAC, ESPSYRSKFAC, ESBI-

ORSKFAC and ESOTHRSKFAC) revealed to have no statistically significant individual explanatory power for the total number of work-related accidents occurring in an establishment (as shown in the Appendices 5 and 6.1). In fact, their *p-values* are, respectively, 0.1169, 0.1860, 0.3028 and 0.7729 (all of them higher than $\alpha = 0.05$).

Regarding the impact of the number of different MSD risk factors to which the workers are exposed on the total number of work-related accidents occurring in the establishments, the conclusions that could be taken were compromised by the serious collinearity between the corresponding ESMSDRSKFAC quantitative variable and the ESPHYRSKFAC quantitative independent variable. This serious collinearity dictated the non-inclusion of ESMSDRSKFAC in the unrestricted model, in spite of having shown a statistically significant individual explanatory power for the dependent variable (*p-value* = 0.0000) and a positive correlation with the latter, as it would be expected (cf. Appendices 5 and 7).

H11 - The establishments that present a higher level of risk factors coverage by risk prevention measures show, *ceteris paribus*, a smaller total number of work-related accidents. The conclusions that could be drawn from this hypothesis testing were hindered by the serious collinearity between the level of coverage of the occupational risk prevention measures implemented in the establishments (ESCOVRSKMEA quantitative variable) and the ESCOVINFOAC quantitative variable, which led to the non-inclusion of the former in the model. Notwithstanding the above, it is worth noting that ESCOVRSKMEA has statistically significant individual explanatory power for the number of work-related accidents occurring in the establishments (has a *p-value* = 0.0002) and, as it also happens with the ESCOVRSKMEA variable, is positively correlated with the dependent variable, as it would be expected (cf. Appendices 5, 6.1 and 7).

4.8 Concluding remarks

The modelling carried out leads to the conclusion that the following variables are predictors with statistically significant effects (at the conventional significance level of $\alpha = 0.05$) for the total number of work-related accidents occurred in establishments with OSH services organized where fatal work-related accident has occurred: establishment's size (in terms of the average number of persons who work there, including employees, subcontractor's workers, temporary workers and self-employed workers), organization modality of the occupational safety services implemented in the establishment, number

of different physical risk factors to which establishment's workers are exposed and establishment's main economic activity sector.

It also allows concluding that the following independent variables have no explanatory power, at the aforesaid significance level, for the total number of work-related accidents occurring in establishments with OSH services organized where fatal work-related accidents took place: organization modality of the occupational health services implemented in the establishment, level of coverage of the information actions carried out in the establishment, establishment's size in terms of the average number of other workers that work there (i.e. subcontractor's workers, temporary workers and self-employed workers), organization of health promotion programs in the establishment and organization of occupational risk prevention programs in the establishment.

Moreover, it is also possible to conclude, as expected, that all predictive variables, with the exception of the internal occupational safety services (ESSAFINT) present a positive correlation with the total number of work-related accidents occurring in the establishments, although with differentiated impacts.

The marginal impact of quantitative explanatory variables on the total number of work-related accidents in establishments, measured by the estimated value of the respective parameter, varies between a minimum of 0.025 (in the case of the average number of persons working in the establishment) and a maximum of 0.526 (in the case of the number of different physical risk factors to which the workers are exposed in the establishment). On the other hand, the marginal impact of the qualitative explanatory variables on the total number of work-related accidents in establishments varies between a minimum of 7.738 (in the case of the establishments belonging to the secondary sector) and a maximum of 12.381 (in the case of establishments with external occupational safety services). ESSAFEXT is the explanatory variable, among the ones included in the model restricted version, which features a higher marginal effect on the total number of work-related accidents occurring in the establishments and, as it would be expected, its impact is positive. ESSAFINT (establishments with internal occupational safety services) is the only explanatory variable which features a negative marginal impact (of -9.102) on the total number of work-related accidents occurring in the establishments, as it would be expected.

The restricted multiple linear regression model also allows the following conclusions:

1. Establishment's size (in terms of the average number of persons who work there): *Ceteris paribus*, the larger the establishments's size in terms of the average number of persons who work there (employees and workers of other employers, including subcontractors' workers, temporary workers and self-employed workers) the greater is expected to be its total number of work-related accidents. The increase of one person in the average number of persons working in a given establishment will induce, *ceteris paribus*, an increase of 0.025439 in the total number of work-related accidents occurring in that establishment.
2. Organization modality of the occupational safety services implemented in the establishment: the implementation of external occupational safety services in a given establishment, rather than the reference category organization modality, is likely to lead, *ceteris paribus*, to an increase of 12.38149 in the total number of work-related accidents registered in that establishment; whereas the option for the implementation of internal occupational safety services, instead of the reference category organization modality, is likely to induce, *ceteris paribus*, a decrease of 9.101567 in the total number of work-related accidents occurring in that establishment. In fact, and *ceteris paribus*, moving the occupational safety services organization modality from the reference category to external services will induce an increase of about 12.4 in the total number of work-related accidents, while moving it to internal services will reduce that number by almost 9.1.
3. Number of different physical risk factors to which establishment's workers are exposed: The establishments in which the workers are exposed to a greater number of different physical risk factors present, *ceteris paribus*, a higher total number of work-related accidents. The greater the number of different physical risk factors to which the workers are exposed in a given establishment, the greater will be, *ceteris paribus*, the total number of work-related accidents recorded in that establishment. A unit increase in the number of different physical risk factors to which the workers are exposed in a given establishment induces, *ceteris paribus*, an increase of approximately 0.53 in the total number of work-related accidents occurring in that establishment.
4. Establishment's main economic activity sector: Establishments whose main economic activity sector is the secondary sector (manufacturing or construction establishments) present, *ceteris paribus*, a total number of work-related accidents higher than the ones registered in establishments of the primary and tertiary sectors.

Moving an establishment from the primary or tertiary sectors to the secondary sector induces, *ceteris paribus*, an increase of about 7.7 in the total number of work-related accidents occurring in that establishment.

4.9 Main policy implications

The results and conclusions of the research on this topic suggest that the improvement of the POSHMS effectiveness in preventing work-related accidents requires the adoption of several policy measures and a sizeable change on the *modus operandi* of the competent authorities.

One of the main policy implications resulting from this research topic seems to be the need for a paradigm shift. Indeed, the lack of explanatory power of several important OSHMS components, suggests its ineffectiveness in preventing the occurrence of work-related accidents in Portugal. This is the case, for example, of the organization of health promotion and occupational risk prevention programs, the level of coverage of the information, training, consultation and health promotion actions, the emergency internal structure for first aid, fire-fighting and evacuation of premises and the number of different measures adopted to prevent occupational risk factors. In this context, the *modus operandi* of the competent authorities, namely in what concerns their inspection activity gesture and approach, should shift. The traditional approach of ensuring and enforcing legal obligations on employers and promoting and strengthening control and supervision of purely formal aspects of compliance with the legislation in force, mainly through the imposition of sanctions, appears to need a change. The activities of the competent public authorities should, therefore, be guided, above all, by the analysis of the appropriateness and effectiveness of the systems implemented at each employer/establishment (essentially measured in terms of its impact on reducing work-related accidents) and must be focused on the effective and on-the-spot technical support, improving the effectiveness of these systems at the workplaces. In line, by the way, with the results of Niskanen et al. (2014) research, which argue that labour inspectors should follow up more effectively that OSHMS are being implemented in practice, provide more advice to workplaces, in order to help them exceed the minimum level laid down by law, and choose more often the imposition of binding obligations rather than the mere imposition of fines. This conclusion, moreover, is consistent with the results of the research carried out on the labour inspectorates' performance assessment, discussed in

the following chapter, which found that the labour inspectors' gesture and approach seem to have an important impact on the ACT local branches relative effectiveness.

Furthermore, the evidence that the organization modality of internal occupational safety services is likely to induce the reduction of the total number of work-related accidents while the external modality is likely to induce its increase, needs also to be addressed. This is particularly true considering that in spite of the use of other organization modality of the occupational safety services than the internal services requires a special authorization to be required to and granted by the ACT, between 1 January 2013 and 31 December 2015, only 15 such requirements (8 in 2013, 3 in 2014 and 4 in 2015) were submitted to ACT (ACT, 2015c, 2016c). In addition, and during the same period, ACT only performed 134 audits to the functioning of OSH external services (8 in 2013, 30 in 2014 and 96 in 2015) (ACT, 2015c, 2016c). Given the findings of this research, it is deemed essential the launch of a national campaign of information and awareness-raising on the various organization modalities of OSH services, in particular with regard to its nature and technical and legal requirements. It is also considered paramount the intensification of the supervision and control of the operation, quality, appropriateness and effectiveness of the OSH services implemented by the employers in their establishments, as well as of the audits to the OSH external services providers.

In addition, the finding of a positive and statistically significant correlation between the number of different physical risk factors to which the workers are exposed in the establishments and the total number of work-related accidents also stresses the emergency of the adoption of policies and measures more likely to promote a deeper understanding of physical risk factors and its most adequate preventive measures. Especially in view of the lack of individual explanatory power of the number of different physical risk prevention measures implemented in the establishments and taking into account that, in 2012, more than half of fatal work-related accidents recorded in Portugal occurred during the use of machines or work equipment (ACT, 2015g). In this context, initiatives such as the Campaign for the Prevention of Occupational Risks in Machinery and Work Equipment 2015, launched by the ACT on 23 January 2015 (ACT, 2015e), are more than welcome. Moreover, and besides the convenience of launching other information and awareness-raising campaigns (e.g. noise, vibrations, lighting and work environment), the results of this research topic also indicate the need for better *in situ* technical support to employers in the area of occupational risks management and the relevance of reinforcing the control on the employers' fulfillment of their legal obliga-

tions regarding the assessment of the risks to which their workers are exposed and the effective implementation of the most appropriate prevention measures.

This research topic results also suggest that both the attention of the policy makers and the scarce resources of the competent public authorities should be focused on larger establishments, rather than on smaller ones, which, in turn, will require another OSH policy considerable change, since both the European and the Portuguese OSH strategic priorities are mainly focused on the promotion of OSH in micro enterprises and SMEs (European Commission, 2014; Portuguese Government, 2015e). A possible way forward could be the enlargement of the measure number 12, foreseen in the PNSPOSH (constitute joint committees for large sites of civil construction and public works, with the participation of their respective social partners and other institutional partners), to large establishments of other activity sectors (e.g. large factories, large quarries and mines, large farms, large logistic centers and hypermarkets).

Moreover, the statistical significance and impact of the main economic activity sector of the establishments on their total number of work-related accidents suggest, in line, incidently, with the PNSPOSH, that the competent authorities scarce resources and the attention of policy-makers should be focused on the promotion, technical support, control and enforcement of OSH in establishments of the manufacturing and construction industries. This conclusion, on the other hand, seems consistent with the finding that the relative effectiveness of the ACT local branches is, *ceteris paribus*, as lower as higher is the volume of the employed population operating in the economic activity sectors of their areas of jurisdiction that expose the workers to a higher level of occupational risks and which, typically, present higher work-related accidents incidence rates (e.g., the manufacturing and construction sectors), as discussed in the following chapter.

Finally, and considering the data limitations discussed in the following section, and the relevance recognized to the collection, analysis and provision of reliable and timely statistical data on work-related accidents, in order to improve the quality of policy decisions in this field (European Commission, 2014; ILO, 2017), it should be considered the improvement of the ‘Annex D’ form of the Annual Single Report on OSH Service Activities (cf. Annex 2), namely through the revision of the processes of both the risk assessment data collection and the incidence rates estimation.

4.10 Main limitations

The results of this research, on the critical factors of the PMOSHMS in preventing work-related accidents, should be interpreted with some caution, considering some limitations regarding the data used.

One of these limitations concerns the lack of official data on potentially important explanatory variables related to the activities of risk assessment in the establishments (e.g. number of risk assessments performed by occupational risk factor and workstation and level of coverage of identified risk factors and workstations by the risk assessments performed). This limitation stems from the fact that the computer program through which the data for the 'Annex D' of the Annual Single Report on OSH Service Activities is electronically collected (in particular the data for the source questions 5.1.3, 5.2.5, 5.3.5, 5.4.3, 5.5.3 and 5.6.3 of 'Annex D' - see Annex 2) registers automatically, and by default, one risk assessment for each of the risk factors, as soon as these are identified, regardless the fact of these risk assessments have been, or not, effectively carried out.

The other limitation regards the absence of an aggregate indicator, or composite index, likely to allow the assessment of the level of work-related accidents in a given establishment or employer considering, jointly, through an appropriate weighting, the different level of severity of the occurred fatal and non-fatal work-related accidents. In fact, the incidence rates data estimated and exhibited in the points 1.2, 2.2 and 3, of section V of the 'Annex D' of the Annual Single Report on OSH Service Activities present several practical limitations (cf. Annex 2): (1) the frequency rates and severity rates concern only the non-fatal work-related accidents, whose victims are the employees of the employer that were assigned to the establishment where the accidents took place (see paragraph 1.2 of section V); (2) the total incidence rate only refers to workers of other employers in the establishment and mixes the fatal work-related accidents with the non-fatal ones, without any weighting of the different degree of seriousness (see point 2.2.1 of section V); (3) the incidence rate of fatal work-related accidents, only refers to the fatal work-related accidents which occurred with workers of other employers at the establishment (see point 2.2.2 of section V); (4) the synthetic indicator of the point 3.1 of the section V (total incidence rate) also mixes the fatal work-related accidents with the non-fatal ones, without any weighting, and relates them with the total number of persons who worked at the establishment; and (5) the synthetic indicator of the point 3.2 of

the section V (incidence rate of fatal work-related accidents), only refers to fatal work-related accidents and relates them with the total number of persons who worked at the establishment.

4.11 Paths for future research

The discussion of the results of the research on this topic, as well as some data limitations, seem to suggest the need for a future deepening of several aspects of the current research.

Notably, the mixed results concerning the associations between the occurrence of work-related accidents and the size of both the employer and the establishments, seem to provide an interesting and challenging opportunity for further research.

Moreover, the apparently contradictory results concerning the association between the occurrence of work-related accidents and the economic activity sector of both the employers and the establishments, seems also to suggest the need for further research on the effects of the economic activity sectors of both the establishments and the employers on the work-related accidents.

In addition, and building on the abovementioned data limitations, it would be especially welcome a research on the development of an indicator (or composite index) likely to allow the assessment of the level of work-related accidents in a given establishment or employer considering, simultaneously, through an appropriate weighting, the different level of severity of the occurred fatal and non-fatal work-related accidents.

Finally, and considering the research gaps on OSHMS discussed earlier (Eisner & Leger, 1988; Frick et al., 2000; Gallagher & Underhill, 2012; Gallagher et al., 2001; Guastello, 1991; Robson et al., 2007; Stolk et al., 2012), especially regarding Portugal, it is considered particularly useful and timely the development of further research on the identification of the critical factors of the PMOSHMS implemented in establishments where no work-related accidents occurred, in order to compare the results of such study with the results of this one, as well as on the identification of the critical factors of the PMOSHMS effectiveness in preventing occupational diseases.

Chapter 5 - Labour inspectorates' efficiency and effectiveness assessment as a learning path to improve work-related acci- dents prevention

Chapter 5 - Labour inspectorates' efficiency and effectiveness assessment as a learning path to improve work-related accidents prevention¹⁶

Summary

The main purpose of the research on this present topic is to assess the efficiency and effectiveness of the ACT in preventing work-related accidents, in order to identify possible weaknesses and improvement paths. It also aims at proposing Data Envelopment Analysis (DEA) as a suitable performance measurement technique for assessing the performance of labour inspectorates.

The population to study comprises the 32 ACT local branches. Their relative performance was measured on the basis of multiple input, output and outcome indicators, through the use of three DEA models: resource efficiency model, cost efficiency model and effectiveness model.

The results indicate that the ACT has a considerable scope for both efficiency and effectiveness improvement. In particular, they suggest that the ACT local branches efficiency might be improved through the resizing of their jurisdiction areas to ensure a better match between their size and the volume and geographic distribution of the employers and of the employed population, the reallocation of their resources from the ones featuring an excessive size to the ones featuring a size too small, and the adoption of a human resources policy focused on the staff rejuvenation and on the increase of the staff levels of education and training, especially in the case of the labour inspectors.

The research findings also show that the ACT local branches effectiveness would benefit from the redesign of their local branches jurisdiction areas, in order to ensure a relatively higher allocation of their resources to those economic activity sectors with higher incidence rates of work-related accidents and a larger volume of employed population. The results also suggest that the ACT local branches effectiveness is expected to improve with the reduction of the ratio of the number of workers to be served per labour inspector, especially in the above sectors, and the strengthening of the staff level of edu-

¹⁶ It is expected that a shorter version of the research on this topic may be submitted soon for publication, to a peer reviewed and indexed international journal on operations research or on operations management (e.g., *Omega*, *Operations Research*, *Journal of the Operational Research Society*, *European Journal of Operational Research*, *International Journal of Operations & Production Management* or *Journal of Productivity Analysis*).

cation and training, in particular of the labour inspectors. The research results also revealed that the adoption of policy measures aimed at tackling its workforce ageing may contribute to improve its effectiveness. The same applies for the adoption of a closer and more specialized inspection gesture and approach, essentially pedagogical in nature, focused on substantive compliance and targeting employers' establishments operating in high risk economic activity sectors. Moreover, the results also pointed out that the ACT local branches effectiveness is likely to improve through the creation of specialized sectoral inspection teams and the implementation of continuous OSH awareness-raising campaigns.

5.1. Introduction

In order to counteract the pandemic phenomena of work-related accidents and their destructive consequences at human and financial levels (EU-OSHA, 1998; Fabela & Sousa, 2012; Härmäläinen et al., 2009; HSE, 2015; Leigh, 2011; J. Takala et al., 2014; Jukka Takala, 2005), many Governments around the globe have been developing efforts in the last century to improve the OSH conditions at the workplaces, including through the establishment of labour and OSH standards and regulations at international and national levels (European Council, 1989a; ILO, 1947, 1969, 1978, 1981, 2006a).

Within the scope of these standards, it has been assigned to labour inspectorates the key role of promoting the improvement of labour and OSH conditions at the workplaces, namely through the monitoring and enforcement of the labour and OSH legislation and through the promotion of occupational risk prevention policies (European Council, 1989a; European Parliament, 2014; ILO, 1947, 1969, 1978, 1981, Portuguese Government, 2000a, 2001b, 2007c, 2012c, Portuguese Parliament, 2009a, 2009b, 2009c, 2009d).

While central body of control integrated in the public administration of the various States, labour inspectorates have been facing increasing difficulties in ensuring compliance with the law. Not only because of the consequences in the world of labour coming from the current trend towards the deregulation and flexibilization of the labour relations, induced by the globalization, but also due to the resource constraints with which they have been increasingly confronted (European Parliament, 2014, 2015; ILO, 2006c; Johnstone & Quinlan, 2006; Liao & Chiang, 2012; Miranda & Dias, 2004).

These difficulties, on the other hand, are creating the need, more than ever, for labour inspectorates to justify their public utility to taxpayers. While public agencies financed by the States, labour inspectorates are being increasingly challenged to demonstrate to their stakeholders (citizens, businesses and their organisations of collective representation) the added value and outcomes they provide (Tösine & Wedege, 2013).

In this context, the purpose of the research on this particular topic is to assess the efficiency and the effectiveness of the ACT, as a key player of the Portuguese system of occupational risk prevention, in order to better understand its performance and eventual gaps, as well as to identify possible paths to improve its efficiency and effectiveness in preventing work-related accidents.

It also aims at proposing the DEA methodology as a suitable quantitative technique for assessing and comparing the performance of labour inspectorates, which can complement the results of the more commonly used evaluation methodologies and, at the same time, answering to the call of both the IALI and the ILO, for the development of performance-measuring tools which allow the definition, monitoring, measurement and comparison of labour inspection indicators, intended to assess if the labour inspectorates' activities are aimed at the right direction and to suggest measures to improve their efficiency and effectiveness (ILO, 2006c; Tösine & Wedege, 2013).

The latter seems particularly important considering that, to the best of our knowledge, there are no published studies on the use of DEA to evaluate the performance of labour inspectorates.

In fact, in the literature review carried out within the scope of this research, it was found no publication on labour inspectorates' performance assessment using a single composite measure, nor it was found any study aimed at assessing quantitatively the efficiency and effectiveness of labour inspectorates accounting for the simultaneous use of multiple input indicators (means, resource or leading indicators) and multiple output indicators (result or lagging indicators) duly weighted.

In this context, the application of the DEA performance assessment methodology to assess labour inspectorates' performance would represent a significant added value, mainly due to its ability to synthesize the performance of the labour inspectorates into a single composite and comparable measure and to handle multiple inputs and multiple outputs, with endogenous choice of weights.

With those purposes in mind, the research on this topic starts with a literature review on the key role of the labour inspectorates within the OSH international and national

legal frameworks, the relevance of assessing the labour inspectorates' performance, the Portuguese labour inspectorate, as well as on the labour inspectorates' performance assessment. Subsequently, the research methodology is described, followed by a background on DEA, the description of the proposed conceptual framework and the DEA models specification. After that, the results are presented and, afterwards, discussed. The main conclusions of the research are then addressed, followed by their main policy implications. This study finishes with the identification of the research main limitations and some recommendations for further research.

5.2. Literature review

5.2.1 Labour inspection key role within the OSH international and national legal frameworks

The concerns regarding the high incidence rates of occupational accidents and diseases and their overwhelming and damaging consequences, have been leading the policy makers around the world, over the last 100 years, to develop joint efforts to improve the OSH conditions at the workplaces as a mean to prevent the occurrence of work-related accidents (Hämäläinen et al., 2009).

These efforts, moreover, have been embodied in several international labour standards (European Council, 1989a; ILO, 1947, 1969, 1978, 1981, 2006a).

Within this international and national labour and OSH legal frameworks, it was assigned to the labour inspection the key role of promoting the improvement of working conditions and the monitoring and enforcing of the compliance with labour and OSH regulations (European Council, 1989a; European Parliament, 2014; ILO, 1947, 1969, 1978, 1981, Portuguese Government, 2000a, 2001b, 2007c, 2012c, Portuguese Parliament, 2009a, 2009b, 2009c, 2009d).

However, and despite the importance commonly recognized to such international and national standards and regulations, the truth seems to be that, without proper implementation and enforcement, they are pointless and will remain just pieces of paper (Anderson, 2007; ILO, 2007; Jensen, 2004; Richthofen, 2002; Suard, 2016). Especially taking into account the results of the Second European Survey of Enterprises on New and Emerging Risks (EU-OSHA, 2014), which found that the major reason for addressing OSH in the EU 28 countries' establishments is the fulfillment of legal obligations

(85% of the establishments) and the third driver is avoiding fines from the labour inspectorate (78%), whereas in Portugal those reasons are argued by, respectively, 94.5% and 93.3% of the establishments, as noted Suard (2016), Irastorza et al. (2016) and the European Parliament (2015).

In this context, the European Parliament underlines the need for a stronger focus on the implementation and enforcement of OSH legislation as an important component in the protection of workers' health and productivity, which considers an indispensable prerequisite for compliance with OSH requirements that protect workers' health, whereas labour inspections play an important role (European Parliament, 2015). Moreover, and considering that the violation of OSH legal requirements often leads to accidents at work (Frick, 2011), labour inspection is understood as an important instrument to promote safer and healthier working conditions and, in this way, to prevent work-related accidents (Alli, 2008; ILO, 1996, 2003, 2005, 2006c, 2007, 2011a; Richthofen, 2002; Jukka Takala, 2005).

Indeed, and despite the recognition that OSH conditions and their impact on the occurrence of work-related accidents are influenced by multiple factors (Tösine & Wedege, 2013) and that a coherent national system of occupational risk prevention involves the cooperation of several actors besides the labour inspection (e.g. employers, trade unions, industry representatives, OSH professional organizations and other government agencies and departments), it is widely acknowledged that the labour inspectorates play a central, indispensable and critical role in the improvement of the working conditions at the workplaces (Tösine & Wedege, 2013) by enforcing the law, working in partnership with the other actors and coordinating the implementation and evaluation of policy measures, within the framework of such national system (ILO, 1947, 1969, 1978, 1981; Portuguese Parliament, 2009a).

As such, it is generally accepted and expected that the labour inspectorates, provided with the necessary resources and carrying out their duties effectively (monitoring and enforcing the labour legislation, giving information and technical advices, promoting awareness-raising campaigns and implementing occupational risks prevention policies), should be able to positively influence the working conditions of workers, improving their OSH conditions at the workplaces and, consequently, producing positive outcomes, in particular in terms of reducing the number of work-related accidents (Anderson, 2007; Frick, 2011; ILO, 2007; Jensen, 2004; Levine et al., 2012; Niskanen et al., 2014; Richthofen, 2002; Suard, 2016; Tösine & Wedege, 2013).

5.2.2 The relevance of assessing the labour inspectorates' performance

Notwithstanding the widely recognition of the labour inspection relevant role, the changes in the world of work (in particular regarding the increased deregulation and flexibility) and the labour inspection's lack of resources (ILO, 2006c; Liao & Chiang, 2012) are leading to increased difficulties for labour inspectorates to ensure compliance with the law (European Parliament, 2014, 2015; Johnstone & Quinlan, 2006; Miranda & Dias, 2004).

The seriousness of such constraints already led to the European Parliament's Resolution No. 2013/2112(INI), of 14 January 2014 (European Parliament, 2014) which stresses that, in order to the labour inspectorates perform effectively their vital role of monitoring and enforcing OSH regulations compliance at workplaces, giving advices on their requirements fulfillment and preventing occupational accidents and diseases, the Member States should ensure: (1) the increase of their staffing levels and resources and the attainment of the target of one inspector for every 10,000 workers, as recommended by the ILO¹⁷; (2) the imposition of more severe, proportionate and dissuasive penalties on firms that fail to comply with their obligations; (3) that all categories of workers irrespective of their employment relationship status (fix-term employed, permanent worker, temporary worker, tele-worker, home worker, self-employed, undeclared worker, etc.) come under the responsibility of the national inspection authorities and must enjoy the same degree of protection; (4) that proper and sufficient training is provided to labour inspectors with a view to tightening up enforcement of EU labour law; that labour inspectors are authorized to use smart inspection tools, employ risk-based supervision and target repeat offenders and those sectors which have been identified as posing the highest risks to workers, while still performing randomized inspections; that labour inspectorates can cooperate and exchange electronic data and information with other relevant national and international authorities; and should ensure that the financial reforms being carried out in certain Member States are not done at the expense of reducing staff, funding and technical resources to the labour inspectorates (European Parliament, 2014).

¹⁷ The technical services of the ILO responsible for labour inspection consider that the number of labour inspectors in relation to workers should be approximately the following: in industrial market economies: 1/10,000; in rapidly industrializing economies: 1/15,000; in transition economies: 1/20,000; and in least developed countries: 1/40,000 (ILO, 2006b:66).

These constraints, moreover, are making it somewhat more difficult to labour inspectorates, whilst more important, to demonstrate their value, through measuring its effectiveness in maximizing the social return resulting from the scarce resources invested in the fulfilment of their mission, of improving OSH conditions and preventing work-related accidents and occupational (Tösine & Wedege, 2013).

In face of the above, it is understood as essential that the labour inspectorates can demonstrate to citizens that they make good use of taxpayers' money in the achievement of their objectives and in the provision of valuable outcomes, as noted Michele Patterson (President of the IALI), who believes it to be a key strategy to promote safe, healthy and decent work outcomes (Tösine & Wedege, 2013).

As an absolutely essential aspect of good governance and accountability of public services, the labour inspectorates should be able to demonstrate that they can achieve their objectives efficiently and effectively, through their performance assessment and reporting (Tösine & Wedege, 2013).

In particular, it is important that labour inspectorates are able to demonstrate their positive influence on OSH conditions at the workplaces and, especially, the extent to which they contribute to the implementation of OSH public policies and ensure the improvement of the working conditions, providing palpable benefits and outcomes to workers, employers and the society in general (Tösine & Wedege, 2013).

In addition, the adoption by the labour inspectorates of a performance assessment system is also found an essential step towards their strategic management, enabling them to measure, monitor, compare and correct their performance on a timely basis, contributing decisively to the improvement of their efficiency and effectiveness in the promotion of OSH in the workplaces and in the prevention of work-related accidents (ILO, 2006c; Tösine & Wedege, 2013).

5.2.3 The Portuguese labour inspectorate

5.2.3.1 ACT mission, organization and legal competencies

One of the essential aspects of Portuguese labour and OSH legal framework is the prediction, in line with the ILO Conventions 81 and 129, of the existence of a central authority (the ACT), with the mission to promote the improvement of working conditions and to enforce the labour standards.

The ACT mission is to promote the improvement of the working conditions, through the monitoring and enforcement of the compliance with the labour relations and OSH regulations, as well as to promote policies to prevent occupational risks, both within the scope of private employment relations and within the scope of the Public Administration, in all economic activity sectors (Portuguese Government, 2012c).

ACT is a central service of the direct administration of the State, endowed with administrative autonomy, with legal jurisdiction in Continental Portugal, through a network of 32 decentralized services (local branches), whose areas of territorial competence cover the areas of level III of the national nomenclature of territorial units for statistical purposes (ACT, 2007; Portuguese Government, 2007d, 2007e, 2012c), as illustrated in Figure 1.



Figure 1 - Distribution of the 32 local ACT branches in the continental territory of Portugal

Source: Own elaboration, based on Portuguese Government (2007d, 2007e, 2012c) and ACT (2007)

It is considered essential the existence of local services, next to the subjects of labour relations and their representatives. It is understood that the effectiveness of the ACT is a

function of the extent to which it knows and understands the social and economic features of its jurisdiction area and its main social, economic and judicial actors. This proximity to the workers and enterprises is also important to facilitate the accessibility of workers and enterprises to ACT services, to anticipate non-compliance phenomena, to ensure a proactive action and to allow a quick action. Moreover, the local services ACT work as ‘antennas’ that monitor the social and labour climates of their areas of jurisdiction, thus allowing a better adaptation and appropriateness of the interventions to the specific conditions, circumstances and local needs. The ACT local branches have areas of jurisdiction with varying sizes, ranging from 151 (Lisbon branch) to 13,851 (Beja) square kilometers (PORDATA, 2013). Furthermore, they serve an employed population with very different volumes, ranging from 34,320 workers, in Covilhã, to 578,636 workers, in Porto (INE, 2013).

ACT is headed by an Inspector General assisted by two Deputy Inspector Generals. It is composed by two main bodies (the Inspector General and the Advisory Committee for the Promotion of Safety and Health at Work), has an hierarchical structure in the areas of management, technical support, promotion of OSH and inspection (Portuguese Government, 2012c) and is organizationally structured as portrayed in Figure 2:

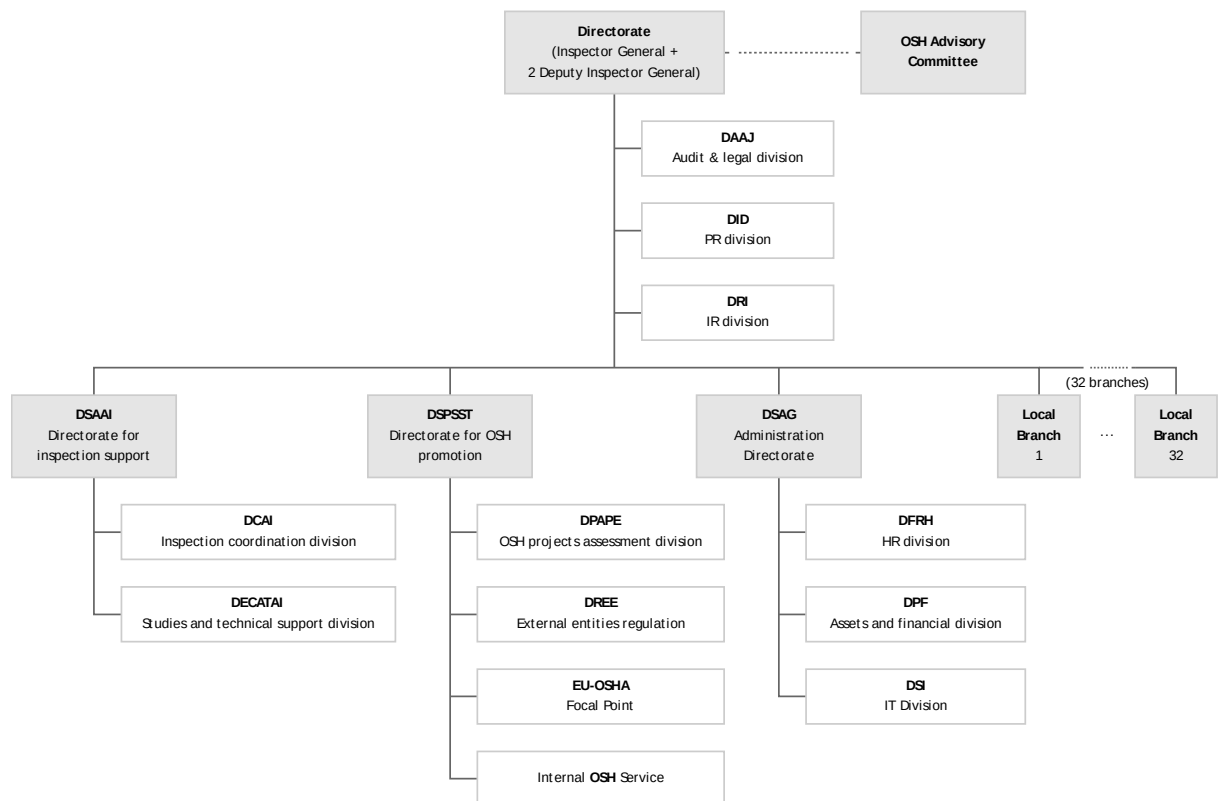


Figure 2 - Organizational chart of the ACT

Source: Own elaboration, adapted from ACT (2015a:8) and based on Portuguese Government (2007d, 2007e, 2012c) and ACT (2007)

On the Portuguese autonomous region of the island of Madeira, the functions of labour inspection are provided by the Regional Directorate of Labour and Inspection Activity, which is a service of the direct administration of the Autonomous Region of Madeira, integrated in the Regional Department of Social Affairs and Inclusion of the Regional Government of Madeira (Regional Government of Madeira, 2016).

On the Portuguese autonomous region of the island of Azores, the functions of labour inspection are provided by the Regional Labour Inspectorate of Azores (Regional Government of Azores, 2001), which is integrated in the the Vice-Presidency for the employment and business competitiveness of the Regional Government of the Azores (Regional Government of Azores, 2012).

The main duties and responsibilities assigned to the ACT, in the field of OSH, comprise the following (Portuguese Government, 2012c:article 2, paragraphs 2,4; article 4, paragraph 1; Portuguese Parliament, 2009a:article 14, paragraphs 1,2):

1. To promote, monitor and enforce compliance with legal provisions, relating to labour relations and working conditions, in particular those relating to safety and health at work, according to the principles laid down in ILO Conventions ratified by Portugal and impose the sanctions corresponding to their non-compliance¹⁸;
2. To promote actions and campaigns to raise awareness and provide information and advice to employers, workers and their representatives about the most appropriate mode of observing the legal provisions incorporated within the competence of the General Labour Inspectorate¹⁹;
3. To promote the development, dissemination and application of scientific and technical knowledge concerning safety and health at work and to promote specialized training in the fields of safety and health at work;
4. To promote and participate in the drafting and implementation of policies on safety and health at work and to suggest appropriate measures in case of lack or inadequacy of legal or regulatory standards;
5. To ensure the management of the national system for the prevention of occupational risks;

¹⁸ In accordance with what is laid down, in particular, in articles 5, 6, 10 and 11 of the Statute of the Portuguese General Labour Inspection, approved by the Decree-Law No. 102/2000, of 2 June (Portuguese Government, 2000a) and in paragraph 1 and paragraph 2-a) and 2-k) of article 2 of the Regulatory Decree No. 47/2012, of 31 July (Portuguese Government, 2012c).

¹⁹ As also foreseen in paragraph 1-a) or the article 10 of the the Statute of the Portuguese General Labour Inspectorate, approved by the Decree-Law No. 102/2000, of 2 June (Portuguese Government, 2000a).

6. To manage the process of authorization of OSH services and to coordinate the process of training and certification of OSH senior technicians and OSH technicians;
7. To support public and private entities in the identification of occupational risks, in the application of preventive measures and in the organization of OSH services and to cooperate with other public administration with a view to the full respect of labour standards;
8. To participate, in conjunction with the competent services of the Ministry of Education, in the preparation of curriculum content, with a view to the introduction of materials on safety and health at work, for all degrees of education and vocational training;
9. To carry out investigations and inquiries in case of fatal work-related accidents, accidents at work showing a particularly serious situation and in the case of occupational diseases²⁰.
10. To ensure the implementation of the measures of the EU strategy for health and safety at work (European Commission, 2014) and to ensure the implementation and the evaluation of the national strategy for health and safety at work (Portuguese Government, 2015e)

As far as the ACT activities and powers are concerned, the Statute of the Portuguese General Labour Inspection, approved by the Decree-Law No. 102/2000, of 2 June (Portuguese Government, 2000a) and Regulatory Decree No. 20/2001, of 22 December, which defines and regulates the labour inspector career (Portuguese Government, 2001b), provides labour inspectors with the necessary powers of public authority and assigns to them the generality of the activities and powers laid down in the ILO Conventions Nos. 81 and 129, as well as some others.

These activities and powers include, in the areas more closely linked to the safety and health at work and the prevention of work-related accidents, the following²¹:

1. To visit and inspect any workplace at any time of the day or night, without prior notice, and develop the actions necessary for the assessment of working conditions.

²⁰ In line with what also provides for the paragraph e) of article 10 of the Statute of the Portuguese General Labour Inspection.

²¹ As provided in articles 10 and 11 of the Statute of the Portuguese General Labour Inspection (Portuguese Government, 2000a) and in the article 3 of the Regulatory Decree No. 20/2001, of 22 December, which defines and regulates the labour inspector career (Portuguese Government, 2001b).

2. To provide technical information and advice to employers, employees and their representatives about the most appropriate way to comply with the legislation.
3. To notify the employers so that, within a prescribed period, the modifications necessary to ensure the safety and health of workers at the workplace are carried out, as well as to adopt the necessary preventive measures in the field of occupational risk assessment.
4. To adopt immediately executory measures, including the suspension of work in progress, in case of serious risk or serious probability of occurrence of work-related accidents or damages to worker's health.
5. To carry out joint verification visits and give opinions regarding the OSH aspects of the installation, modification and operation licensing of establishments.
6. To request (with immediate effect or to show afterwards in the competent local branch), examine and copy documents and other records and make photographic records, video images and measurements, as well as adopt necessary precautionary measures and appropriate to prevent the destruction, the disappearance or alteration of documents and other records.
7. To interrogate the employer, employees and any other person who is in the workplace, request their identification, notify witnesses, experts or any other persons to attend to the office of the ACT territorial competent branch, and to make arrests in flagrante delicto.
8. To receive the collaboration and be accompanied by experts, technicians and by the representatives of workers and employers associations.
9. To require the demonstration of work processes, request information on the composition of products, materials and substances used in workplaces and to collect and take samples for analysis.
10. To adopt, at any time of the inspection, the precautionary measures necessary and appropriate to prevent the destruction, the disappearance or the alteration of documents and other records, as well as of products, materials and substances.
11. To conduct inquiries in cases of occupational diseases, fatal work-related accidents or work-related accidents showing a particularly serious situation.
12. To apply the inspection procedures understood as the more suitable to the regularization of the situation in hand (e.g., request notice, warning notice, improvement notice, suspension notice, notices to establish debts to workers and to so-

cial security, infraction notices and administrative infraction proceedings for sanctioning non-compliance).

13. To promote the collaboration of other bodies with competence in the field of working conditions and to participate to other competent authorities the observed infractions under their jurisdiction.
14. To control the fulfillment of the legal obligation of the employers of creation of OSH services and its operation.
15. To draw up reports, information and other documents resulting from the inspection activity.
16. To instruct processes concerning administrative permits related to working relationships and conditions.
17. To develop information, opinions and studies of diverse nature, within the competences of the Portuguese general labour Inspectorate.
18. To participate in working groups, committees, project teams and specific missions, for which it is designated.
19. To collaborate in the inspection activity planning, in accordance with the annual work plans, as well as in joint actions developed within the cooperation framework with other regional and interregional inspection systems.
20. To coordinate and perform inspections of regional, interregional and national scope.
21. To instruct the administrative infringement procedures (misdemeanour labour processes) entrusted to them.

5.2.3.2 ACT main activities

Considering the legal competencies, responsibilities and activities legally assigned to the Portuguese Labour Inspectorate, as well as its internal organization, the main and most demanding activities (in terms of resources needed and time consumed) performed by the ACT branches include conducting inspection visits, applying the adequate inspection legal procedures, instructing the administrative infringement procedures, giving information and technical advice to workers, employers and their collective representation structures about the best way to comply with OSH and labour relations regulations and launching information actions and awareness raising campaigns, in order to

foster the effective implementation of the occupational risk prevention policies and contributing to the development of a truly OSH culture.

Below we describe each of these activities, discussing its main objectives and the procedures undertaken.

5.2.3.2.1 Conducting inspection visits

The inspection visits are of paramount importance to promote the improvement of working conditions. They allow the monitoring and enforcement of the regulations on labour relations and OSH, the promotion of the implementation of the most appropriate occupational risk prevention measures at the workplaces, the provision of information and advice to employers, workers and their representatives, and the promotion of the adoption of occupational risk prevention policies.

The Portuguese Labour Inspectorate inspections visits are carried out in accordance with:

1. The legal regime of inspection activity, laid down on the Decree-Law No. 276/2007, of 31 July (Portuguese Government, 2007c);
2. The functional content of the the labour inspector career, as defined in the Regulatory Decree No. 20/2001, of 22 December (Portuguese Government, 2001b);
3. The Statute of the Portuguese General Labour Inspectorate, approved by the Decree-Law No. 102/2000, of 2 June (Portuguese Government, 2000a);
4. The legal activities and competencies assigned to the ACT, as defined in its organic law, approved by the Regulatory Decree No. 47/2012, of 31 July (Portuguese Government, 2012c);
5. The procedural regime applicable to the infringement proceedings concerning the administrative offenses to labour and social security regulations, approved by the Law No. 107/2009, of 14 September (Portuguese Parliament, 2009c);
6. The inspection activity guidelines of the ACT (ACT, 2015f); and
7. The Circular Letter No. 10/DirACT/13, of 30 May, concerning the workplaces inspection visits (ACT, 2013b).

The inspection visits are planned according to the ACT's strategic plan and ACT's approved activities plan for the year in question. Both reflect the requests for action addressed to the ACT, through the various means available (e.g. ACT web site, mail,

email, fax and telephone and in-person information services) as well as its strategic priorities.

The inspections also result from requests for assistance and complaints from workers, employers (and their collective representation structures) as well as from other economic agents and public bodies.

They may also arise from the need to comply with legal obligations, in particular: conducting accidents at work inquiries, at the request of the courts; conducting surveys for licensing economic activities, at the request of the respective coordinator entities; or conducting joint inspections at the request of other inspection services, within the framework of the collaboration between government services, courts and other public authorities.

The inspection visits can still be driven by the identification of needs for action at the initiative of the directors of the decentralised services or labour inspectors, in face of the knowledge of the reality and local phenomena.

Taking into account the scarcity of means and resources with which ACT is confronted, applications for action are analysed, considering the legitimacy of the applicant, the credibility of the source and the relevance of the subject of the complaint.

Moreover, the requests for intervention and the programming of inspections are prioritized according to objective criteria, taking into account the interests concerned, including: the severity of the situations; the number of workers covered; the relevance of the social values to promote; and the possible multiplier effect generated by the intervention. The prioritization still considers the nature of the subjects referred to in the requests for intervention, being privileged those involving the following: situations of serious risk or high probability of a threatening occurrence to the life, physical integrity or health of workers; work-related accidents inquiries; vulnerable workers (minors, pregnant workers, workers who have recently given birth and nursing mothers, workers with children with disabilities or chronic illness, student workers, workers older than 55 years, workers with disabilities and migrant workers); lack of prompt payment of the salary; temporary reduction of normal working period or suspension of the employment contract by the employer (e.g. situations of business crisis, closure or temporary decrease of activity); dismissal on the initiative of the employer (e.g. collective dismissal and workstation extinction); breach of the duty of effective occupation; and violation of collective rights.

An inspection visit involves essentially 5 stages: planning; preparation and organization; realization of the visit; analysis and preparation of the report and remaining inspection procedures; and the decision of the branch director with respect to the inspection process and procedures.

The development of a typical inspection visit is synthetically illustrated in Figure 3.

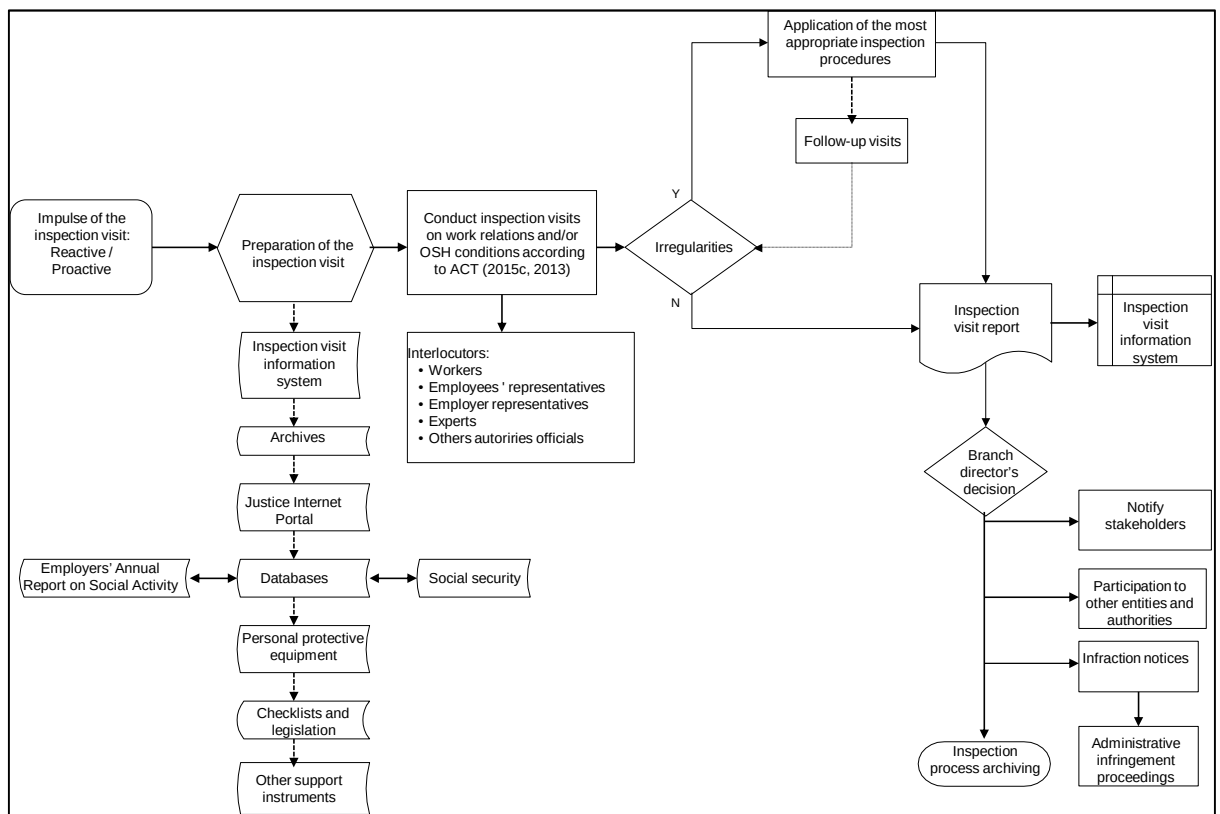


Figure 3 - ACT's typical inspection visit flowchart

Source: Adapted from ACT (2015f:50)

The planning of the visit is reflected in the evaluation and weighting of its opportunity and appropriateness, having regard to the strategy and the activities plan outlined, the resources available, the different requests to the ACT branch in question and any emerging phenomena that requires priority intervention.

The preparation and organization phase include the collection of data and information about the target of the inspection visit and the assembly of the most appropriate means and resources to carry it out.

It involves the search for several information on the targeted employer, through various sources: analysis of the employer file in the computer system and in the employer dossier filed in the delegation; contacts with other labour inspectors who already visited the employer in question; contacts with trade union and OSH representatives in the tar-

get employer; analysis of the targeted employer data available in on-line databases, such as the social security, the justice portal and the Planning and Strategy Cabinet (of the Ministry of Labour, Solidarity and Social Security) database, concerning the data collected within the framework of the fulfilment of his legal obligation to provide annual information on the social activity of the company; investigation on the work and productive processes, technology, work equipments, products, materials and raw materials, via the internet, specially the employer web site, if any, and the review of the relevant literature; investigation on the location of employer and the identification of appropriate interlocutors; and analysis of the expected applicable law and instrument of collective labour regulation. It also requires deciding about several organization issues, namely: number of required labour inspectors (in the ACT, as a rule and for safety reasons, the visits are allways performed by a minimum of two labour inspectors); the pertinence of involving other authorities such as other inspection services (tax inspection services, social security inspection services, judicial inspection services), the police, the foreign and borders service, etc; selection of the more suitable inspection instruments (check lists, procedures, etc.) and other resources (e.g. personal protective equipment, cars, laptops, mobile phones, cameras, tape measures, flashlights, etc.) to carry out; and the possibility of enlarging the scope of the inspection visit.

Regarding the performance of the inspection visits, they are usually carried out without prior notice, i.e., they are not pre announced. Moreover, at the beginning of the inspection visit, the labour inspector usually reports his presence to the employer or his representative, as well as to the representatives of the employees in the company, except when such is likely to compromise the purpose of the visit. Depending on the nature and objectives of the visit, the labour inspector visits one ore more workstations, checking and assessing their working conditions (not only regarding the workplaces OSH conditions, but also regarding labour relations), identifying, talking to and inquiring employees, their representatives and the employer, collecting informations, requesting and analyzing documents, taking notes, filling forms and check lists, taking pictures and making vídeos where needed, and applying the inspection procedures deemed more appropriate to improve the working conditions of the workplace.

At the end of the inspection visit the labour inspector informs the employer and the workers representatives about its results, the irregular situations detected, the procedures applied (or to apply) and about the subsequent actions, except when such information is likely to jeopardize the objectives of the intervention.

Following the visit, the labour inspector analyzes and systematizes the facts established and the respective legal framework and assesses the need for application of other inspection procedures and the need for follow-up visits, particularly to verify the implementation by the employer of the OSH measures he determined and to monitor the evolution of working conditions. In addition, the labour inspector has to register on the computer system the data relating to the inspection visit carried out (characterization of the employer, situations verified, violations detected, inspection procedures adopted, etc.) and to draw up the respective report. The report has to include, besides the inspection procedures already adopted and to be adopted (as annex), the following information: identification of the employer; inspection visit trigger (e.g. activities plan, request to intervene, complaint); framework, objectives of the visit and verified issues; description of the facts verified, adopted methodology, interlocutors, analyzed documents, etc; identification and factual description of the detected infractions; analysis of infractions under the technical and legal point of view, based on the applicable legislation and collective labour regulation instrument; explanation and justification of the inspection procedures already adopted and to be adopted; evaluation of the results obtained in terms of the degree of improvement in the workplace; and proposal for development of subsequent actions.

Completed the report (with the attachment of the procedures already adopted and to be adopted), the same are submitted, to order, to the director of the respective ACT decentralized service. The local competent branch director will assess the sufficiency and suitability of the inspection visit carried out and the legality of the procedures adopted and will ensure the institutional communication between the ACT and the other entities (courts, public authorities, etc.) and, upon its completion, with the entities that boosted it.

The decisions of the director with respect to the inspection process that are subject to order by the inspectors are, usually, one or more of the following: termination and subsequent archiving; agreement with the proposals made by the labour inspector; correction or request for clarification; back to the labour inspector for follow-up; and send the final result to the proposed recipients.

5.2.3.2.2 Applying the legal inspection procedures

In order to improve the working conditions at the workplaces and prevent the occurrence of work-related accidents, Portuguese labour inspectors are provided with several legal procedures, understood as instruments to enforce the compliance with OSH and labour relations regulations and, most of all, to improve working conditions, inducing safer and healthier workplaces and, in this way, preventing accidents at work.

Those legal procedures, foreseen in the legislation, include, among others: work-related accidents inquiries, suspension notices, infraction notices, improvement notices, recommendation notices, notices for the presentation or immediate request of documents and other relevant records, warnings, warning notices, notices to establish debts to workers and/or social security, notices to cease immediately the activity provided by minors, notices to other authorities or entities and notices to the Public Prosecutor.

The ACT labour inspectors are expected to apply the most appropriate legal procedures to the situations encountered, in accordance with the applicable legislation and the ACT's inspection activity guidelines (ACT, 2015f), taking also into account the seriousness and consequences of the infraction, the context in which it was committed, the conduct of the offender, and the prognosis assessment of the most suitable procedure to ensure compliance and the expected results.

5.2.3.2.2.1 Work-related accidents inquiries

In the case of fatal work-related accident or accident at work that indicate a particularly serious OSH situation, the labour inspector carries out the respective investigation and inquiry, as foreseen both in the paragraph 1-e) of the article 10 of the Statute of the Portuguese General Labour Inspectorate, approved by the Decree-Law No. 102/2000, of 2 June (Portuguese Government, 2000a) and in the paragraph 2 of article 14 of the legal framework for the promotion of health and safety at work, regulated by the Law No. 102/2009, of 10 September (Portuguese Parliament, 2009a).

The work-related accidents inquiry is intended to investigate the circumstances and conditions under which the accident at work occurred. It consists of a diagnosis and in-depth study of the existing working conditions, in order to identify its cause, thus allowing the study of the prevention and protection measures more likely to prevent its repetition, as well as the monitoring and enforcement of its effective implementation. The

vital importance of this inspection procedure, viewed as a prevention tool par excellence, justifies, by the way, the provisions of ILO conventions Nos. 81 (article 14) and 129 (article 19), to notify the occurrence of work-related accidents to the labour inspectorates. In fact, and in addition to the identification of the causes of the accident and the most appropriate prevention and protection measures to implement, it monitors and ensures its effective implementation thus inducing the substantive modification and improvement of the existing working conditions. Indeed, the investigation and its follow-ups are expected to prompt the systematic monitoring of the employer concerned. In fact, the action of the ACT in the employer concerned does not end with the completion of the investigation of an accident at work. It continues, with a view to ensuring the effective transformation of the workplace in question, as well as the sedimentation of the practices and procedures more suitable for the sustainable improvement of OSH conditions at the workplace and, in this way, avoiding the occurrence of accidents at work (ACT, 2015f, 2015h, 2016e).

Taking into account the different level of severity of the work-related accidents and the resource constraints of the ACT, the Portuguese Labour Inspectorate has established the goal of conducting inquiries on all fatal accidents at work which have been communicated or which have been aware, as well as in relation to the accidents at work showing particularly serious situations. As for other work-related accidents, ACT's decentralised services should select the inquiries to be carried out on the basis of the following criteria: severity of the accident (considering the number of victims and the severity of injuries); opportunity (intervention priorities laid down in the plan of activities of the ACT, occurrence date, frequency rate, economic activity sector concerned and victims degree of vulnerability); and reliability and relevance of the information provided by the sources as to its occurrence (ACT, 2016e:10-11). In addition to the above mentioned work-related accidents' inquiries, the ACT also carries out the accidents at work inquiries which are requested by the public prosecutor services of the judicial and labour courts (ACT, 2015f).

In general, as soon as the respective ACT local branch is notified (either by the employers or by the workers, bombeiros, serviços de protecção civil, serviços de emergência médica, hospitais, polícia, insurance companies, courts, trade unions, employers associations, etc.) about the occurrence of a fatal work-related accident or an accidents at work which shows a particularly serious situations, several internal steps are sequentially triggered, namely (ACT, 2015h, 2016e):

1. The director of the territorial competent local ACT branch has to inform immediately the Inspector General of the ACT, as well as the two Deputy Inspector General, of such occurrence, by e-mail, sms or phone.
2. The director of the competent local service should also ensure, within the 24 hours following the knowledge of the work-related accident occurrence, the preparation, registration on the computer system and send by e-mail to the Inspector General of the ACT, the preliminary report of the accident at work. This should contain the following elements: severity of the accident (fatal or non-fatal); date, time and day of the week of its occurrence; location of the accident; type of accident (on the premises, on the road or *in itinere*); worker's name and nationality; identification of the employer; employer's tax number and economic activity sector code; and summary description of the accident at work.
3. The director of the competent local service has also to ensure the preparation, conclusion and registration of the final report of the work-related accident inquiry within the time limit set, which should be sent to the Inspector General of the ACT through the computer system.
4. Upon receipt of the final report of the work-related accident inquiry, the Inspector General of the ACT shall disclose it to the Directorate for Inspection Support (DSAAI) and to the Directorate for OSH Promotion (DSPSST).

The preparation of the preliminary report of the accident at work and, most especially, the preparation of the final report of the work-related accident inquiry, presuppose conducting a series of inspection visits.

Moreover, the inspection visits carried out within the context of an work-related accident inquiry involve several steps, which should be taken in order to ensure the collection of all the information, documents, records, data and evidence deemed necessary to understand its causes and to study the most appropriate prevention and protection measures whose implementation is more likely to avoid its repetition.

The following Figure 4 describes sintetically the mains steps to be carried out in the development of a work-related accident investigation:

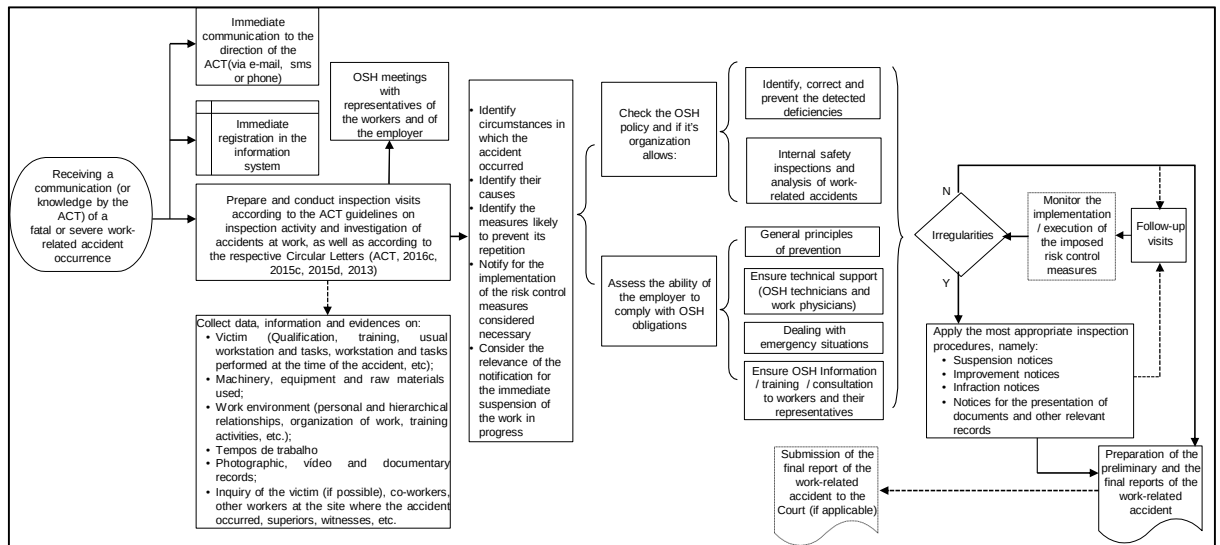


Figure 4 - ACT's fatal or severe work-related accident inquiry flowchart

Source: Adapted from ACT (2015f:Annex 15)

These inspections visits involve essentially the following aspects (ACT, 2013b, 2015f, 2015h, 2016e):

1. To undertake the victim's identification, definition of his functions and duties in the productive process, and collecting information about his training, qualifications and professional experience;
2. To undertake a full identification of the workers involved and their supervisors and managers, as well as the clear definition of the existing hierarchies;
3. To interview the victim, witnesses and respective supervisors and managers, whenever possible;
4. To undertake meetings with the representatives of the employer and the workers' representatives for OSH;
5. To check the type of organization and the duration of working hours provided by the worker in the last 30 days;
6. To perform on-site examination of working conditions in which the victim and other workers develop their activity (workspace, physical environment, organization of work, material components of work, work equipment and machinery, communication, etc.), labour practices at the workplace, as well as the rules and instructions of the employer;
7. To undertake a verification of the adequacy and conformity of the material and technical means used;
8. To check the existence of a OSH policy;

9. To verify if the OSH services and the measures adopted to ensure the OSH at the workplace are leading to the identification, correction and prevention of deficiencies, including those designed to identify hazards and assess risks (in particular the safety internal inspections, the work-related accidents analysis and the production of accidents at work statistics);
10. To check on whether there is risk assessment and, if available, on whether it is technically appropriate to the risks to which the workers are exposed;
11. To evaluate the employer's decisions concerning:
 - a. Plan, organize, execute, monitor and review the measures of prevention and protection in the workplace;
 - b. Ensure the technical support in the field of OSH, inter alia through safety technicians or senior safety technicians;
 - c. Deal with emergency situations (e.g. first aid, fire-fighting and evacuation of premises);
 - d. Provide the workers and/or their representatives, with understandable and relevant information;
 - e. Ensure adequate OSH training for workers;
 - f. Ensure the consultation of the workers and/or their representatives on OSH matters;
 - g. Ensure that the provisions in force in the company effectively protect workers against the risks identified.
13. To define the appropriate measures to be implemented by the employer, to ensure the prevention and protection of the safety and health of workers, the sustained improvement of working conditions and compliance with the law, applying the most appropriate inspection procedures, namely: recommendations; warnings; warning notices; improvement notices; suspension notices; infraction notices; and communication of relevant facts to any other entities or public authorities in charge of ensuring compliance with the law (in particular in the fields of public health, consumer protection, environment, fire safety and licensing);
14. To communicate the results of the visits to the employer or his representative, including a perspective on subsequent follow-up monitoring, necessary to ensure the implementation of the preventive measures identified until the substantive and sustainable improvement of existing working conditions.

Carrying out a work-related accident inquiry is very time and resources consuming. Typically, it involves several inspection visits to interview various persons (e.g. the victim, whenever possible; co-workers; other workers who were at the workplace; witnesses, and experts) and the analysis of several documents. It might also require the demonstration of the work processes, the operation of work equipment and machines and the performance of analysis and tests by experts and certified labs.

Moreover, the work-related accidents inquiries complexity and the volume of data, information and documents involved, lead to the fact that both its interim and final reports are habitually written in the respective ACT branches offices. Furthermore, and taking into account that the occurrence of work-related accidents strongly suggests the existence OSH dysfunctions and non-conformities in the workplace (ACT, 2011b), the work-related accident inquiries often lead to the application of several other inspection procedures, such as suspension notices, improvement notices and infraction notices. In addition, when, in the course of a work-related accident inquiry, serious or repeated malpractices of companies providing external OSH services are detected, the director of the competent local ACT service has to notify the DSPSST director of such fact, in order to promote the evaluation of the conditions under which those companies operate and, in particular, to assess if those companies still meet the needed requirements (e.g. technical, resources and quality) to maintain the ACT authorisation for the provision of such services.

5.2.3.2.2.2 Suspension notices

The notification for the immediate suspension of works is intended to stop immediately the works in progress, in the case of serious risk or high probability of a threatening occurrence to the life, physical integrity or health of workers.

It has legal support in: paragraph 1-d) of the article 10 of the Statute of the Portuguese General Labour Inspectorate (Portuguese Government, 2000a); paragraph 1-d) of the article 10 of the procedural regime applicable to the infringement proceedings concerning the administrative offenses to labour and social security regulations, approved by the Law No. 107/2009, of 14 September (Portuguese Parliament, 2009c); paragraph 2-c) of the article 13 of the ILO convention No. 81 (ILO, 1947); and paragraph 2-b) of the article 18 of the ILO convention No. 129 (ILO, 1969).

The notification for the immediate suspension of work has to include: the identification of the employer, the place of work and their headquarters; the legal entity identification number of the employer; the date and time of the adoption of the suspension procedure; the situations or conditions causing serious probability of injury of the life, physical integrity or health of workers; and the description of the works immediately suspended. It has to be signed by the notified, who must also indicate the capacity in which signs and its civil identification number. The offender must be warned that the failure to comply with the notification is likely to configure the practice of a crime of disobedience, provided for and punished under the paragraph 1 of the article 348 of the Portuguese Penal Code (Portuguese Government, 1995b). In addition, the works that have been suspended by means of a suspension notice can only be resumed with the express permission of the labour inspector, in accordance with paragraph 2 of the article 10 Statute of the Portuguese General Labour Inspectorate (Portuguese Government, 2000a). Such authorization is formalized through the adoption, by the labour inspector, of an authorization notice to resumption of works. This authorization to resume works can only be issued after revision and favourable evaluation of the prevention and protection measures proposed by the offender (in his application to the ACT requiring such authorization) and only after a new inspection visit to verify those measures.

In spite of being usually issued on-site, the suspension notice is a inspection procedure which requires considerable time and resources, not only because of the high responsibility that might arise from stopping the works in progress, but also because it usually implies several inspection visits (with the resulting costs), as well as the application of several other inspection procedures. In fact, and in light of the seriousness of the risks in terms of the probability of occurrence and severity of the damage to which the workers were exposed, the underlying violations to suspension notice frequently give rise to the application of several other inspection procedures such as improvement notices and infraction notices.

5.2.3.2.2.3 Infraction notices

The infraction notice is an inspection procedure, of coercive nature, which aims to promote the improvement of work conditions, through the enforcement of the law and the deterrence of non-compliance.

Besides the enforcement of the offender's compliance with the law and his omitted duties (if still possible), the infraction notice also ensures the proper sanction of his non-compliance, through the imposition of penalties. The latter involves, both the imposition of fines (which, in turn, can be paid voluntarily, coercively - until the end of the administrative infringement proceeding, or through the courts), and, when provided for, of accessory sanctions (e.g. publicity of the conviction, prohibition to participate in public bids and to benefit from public funds, prohibition of the activity).

It is expected that the effective application of infraction notices to deter non-compliance and induce compliance with the labour regulations, is likely to contribute to the improvement of working conditions.

It has legal support in paragraph 1 of article 17 of the ILO convention No. 81 (ILO, 1947); in paragraph 1 of article 22 of the ILO convention No. 129 (ILO, 1969); in paragraph 1 of article 6 and in paragraph 1 of article 7 of the Statute of the Portuguese General Labour Inspectorate (Portuguese Government, 2000a); and in paragraph 1-d) of article 10 and paragraphs 1 and 3 of article 13 of the procedural regime applicable to the infringement proceedings concerning the administrative offenses to labour and social security regulations, approved by the Law No. 107/2009, of 14 September (Portuguese Parliament, 2009c).

The infraction notice should be raised by the labour inspector when, in the performance of his duties, he verifies or confirms, personally and directly, even in a non-immediate fashion, any infraction integrated within the scope of ACT's legal competencies punishable with a fine.

The infraction notice has to describe all the facts which allow to characterize the conduct of the offender (or its default) as an administrative or misdemeanor offence and should include, in particular: the date and time of its application; the name and category of labour inspector who issued it; the identification and the residence of the offender; the headquarters of the collective person and the identification and residence of all respective managers, administrators or directors (when the above are responsible for a collective person or treated as such); the identification and residence of the subcontractor and the main contractor (if applicable); the legal provisions infringed; the applicable penalty; the facts constituting the infraction and that have been verified by the labour inspector, including those relating to the subjective imputation; the date, time, place and circumstances in which they were practiced; and the evidences available.

It is also an especially demanding inspection procedure, in terms of time and resources, not only due to its underlying responsibility, but also because it requires, as a general rule, the completion of more than one inspection visit, the inquiry of employees, the employer and witnesses (and the elaboration and signing of their corresponding statements), the collection of evidences, the analysis and interpretation of documents, the legal framework of the facts established and the wording of the infraction notice itself. Due to its technical complexity and requirements, the infraction notice is usually prepared by the labour inspector in the office and subsequently sent to the offender.

5.2.3.2.2.4 Improvement notices

The improvement notice is the appropriate inspection procedure to impose to the employer the implementation (with immediate effects or within a specified period) of the necessary modifications to the workstations, in order to ensure the compliance with the legal provisions concerning the safety and health of workers at the workplaces, as provided for in the paragraph 2-a) of article 13 of ILO convention No. 81 (ILO, 1947); paragraph 2-a) of article 18 of ILO convention No. 129 (ILO, 1969); in paragraph 1-c) of article 10 of the Statute of the Portuguese General Labour Inspectorate (Portuguese Government, 2000a); and in the paragraph 1-b) of article 10 of the procedural regime applicable to the infringement proceedings concerning the administrative offenses to labour and social security regulations, approved by the Law No. 107/2009, of 14 September (Portuguese Parliament, 2009c).

The improvement notice must indicate: the description of the irregular situations verified, the number of employees affected, the health and safety preventive and protection measures to be implemented and the respective deadline for compliance. Moreover, the labour inspector should inform the employer about the infractions detected that will lead to infraction notices and also regarding the subsequent follow-up steps, unless this practice is likely to harm the objectives of the visit.

The improvement notice is commonly issued and delivered to the employer at the workplaces. Nonetheless, it is also an inspection procedure especially demanding in terms of time and resources, particularly because it requires, as a general rule, the completion of more than one inspection visit, not only to ensure the adequate follow-up of the implementation of the imposed prevention measures, but also because it usually leads to the application of other inspection procedures, such as the infraction notices.

5.2.3.2.2.5 *Other inspection procedures*

Labour inspectors can also apply other inspection procedures, which are not exclusively or specially focused on the improvement of OSH conditions and whose application either does not consume so much time and resources as the ones mentioned above or is less common. These other inspection procedures include, for example: recommendation notices, notices for the presentation (or immediate request) of documents and other relevant records, warnings, warning notices, notices to establish debts to workers and/or social security, notices to cease immediately the activity provided by minors and notices to other competent authorities.

5.2.3.2.2.5.1 **Recommendation notices**

Recommendation notices are a non-coercive inspection procedure provided for in paragraph 1-b) of article 3 and paragraph 2 of article 17 of the ILO convention No. 81 (ILO, 1947), paragraph 1-b) of article 6 and paragraph 2 of article 22 of the ILO convention No. 129 (ILO, 1969) and paragraph 1 of article 5 of the Statute of the Portuguese General Labour Inspectorate (Portuguese Government, 2000a).

This is a procedure applicable to situations which, although likely to influence negatively on working conditions, are omitted in the law or are not specifically provided for or typed as an offense in the legislation. It reflects the activity of providing technical information and advice on how to comply with the legal provisions.

It is an inspection procedure applied by labour inspectors which may or may not involve an inspection visit. In general, it usually requires the completion of one inspection visit, during which it is normally communicated verbally to the employer and, later, formally prepared (in the ACT competent local branch office) and delivered to the employer by mail or e-mail.

5.2.3.2.2.5.2 **Notices for the presentation of documents**

The notices for the presentation or immediate request of documents and other relevant records are an inspection procedure designed to support the investigation and monitoring of the compliance with the applicable legal provisions. In the exercise of their activity, labour inspectors can order with immediate effect or notify for presentation in the ACT competent local branch, to examine and copy, documents and other records

with interest to the clarification of facts within the fields of labour relations and OSH condition, as provided for in the paragraph 1-e) of article 11 of the Statute of the Portuguese General Labour Inspectorate (Portuguese Government, 2000a) and in the paragraph 1-a) of article 10 of the procedural regime applicable to the infringement proceedings concerning the administrative offenses to labour and social security regulations, approved by the Law No. 107/2009, of 14 September (Portuguese Parliament, 2009c).

Failure to comply with a notice for the presentation or immediate request of documents and other relevant records, in addition to constitute an administrative offense, foreseen in paragraph 2 of article 552 of the Portuguese Labour Code (Portuguese Parliament, 2009d) and in paragraph 2 of article 13 of the Statute of the Portuguese General Labour Inspectorate (Portuguese Government, 2000a), is also likely to set up the commission of a crime of qualified disobedience, under the paragraphs a) and b) of article 547 of the Portuguese Labour Code (Portuguese Parliament, 2009d) and paragraph 2 of article 348 of the Portuguese Penal Code (Portuguese Government, 1995b). Thus, the failure to comply with a notice for the presentation or immediate request of documents and other relevant records often leads to the application of the corresponding infraction notice and in sending the competent participation to the Public Prosecutor, accompanied by the respective infraction notice as well as by the respective notice for the presentation or immediate request of documents and other relevant records.

In spite of being an inspection procedure which application does not necessarily require the completion of a inspection visit, it is usually applied during inspection visits, as a formal legal instrument to collect documents, records and others evidences.

5.2.3.2.2.5.3 Warnings

The warning is an inspection procedure resulting from the possibility given to the labour inspectors of providing warnings and advices rather than adopting sanctioning proceedings, as enshrined in the paragraph 2 of article 17 of the ILO convention No. 81 (ILO, 1947) and in the paragraph 2 of article 22 of the ILO convention No. 129 (ILO, 1969).

The warning procedure might be adopted since the infringement consists of rectifiable irregularity, which didn't produce serious and irreparable harm to the workers, to third parties, for the administration of the work or to the social security and there is no evidence of wilful misconduct of the offender in breach of the law.

In the decision on the application of this inspection procedure, the conduct of the offender and the expected effectiveness of the procedure are considered in a judgment of prognosis on the compliance of the offender with the law, taking into account the expected results and the priorities of the inspective action.

This procedure normally requires the completion of one inspection visit, during which it is usually issued. The failure to implement the warned measures, on the other hand, implies, as a general rule, the completion of more than one visit and the application of coercive procedures, in particular, infraction notices.

5.2.3.2.2.5.4 Warning notices

The warning notice procedure is identical to the preceding procedure but, unlike that, it is only applicable to minor offenses that didn't produce serious and irreparable harm to the workers, to the administration of the work or to the social security, as provided for in paragraph 1 of article 10 of the procedural regime applicable to the infringement proceedings concerning the administrative offenses to labour and social security regulations, approved by the Law No. 107/2009, of 14 September (Portuguese Parliament, 2009c).

In addition to the identification of the offender, the workplace and the date and time of the verification of the facts, the warning notice must include: the description of the detected infraction, the measures recommended to the offender and the deadline for compliance.

If the recommended measures are not met, the labour inspector should apply the infraction notice procedure, in order to enforce them and to sanction the omission. In this case the fines will be considerably raised, as a result of the deliberate non-compliance with the warning notice, as foreseen in article 557 and paragraph 1 of article 559 of the Portuguese Labour Code (Portuguese Parliament, 2009d).

The application of the warning notice procedure occurs typically during inspection visits and usually involves the completion of one inspection visit. Nevertheless, when the employer fails to comply with the warning notice measures, it usually involves the completion of additional inspection visits and the application of the corresponding infraction notices.

5.2.3.2.2.5.5 Notices to establish debts to workers and/or to social security

The notice to establish debts to workers and/or to social security is an inspection procedure which aims at ensuring the calculation and payment of debts of the employer to workers and/or to social security, as provided for in paragraphs 4 to 6 of article 7 and paragraph 1-l) of article 11 of the Statute of the Portuguese General Labour Inspectorate (Portuguese Government, 2000a).

The establishment of the amounts owed to workers and/or to social security should take into account the infraction prescription date and indicate: the legal or conventional provisions infringed, the affected workers, the period concerned and, where appropriate, the measures recommended to the offender and the respective deadlines.

In case of employer's failure to comply with the notice to establish debts to workers and/or to social security, the labour inspector performs the calculation of the amounts owed to the workers and/or to the social security and applies the corresponding infraction notice, which is enforceable by law, as predicted in the paragraph 5 of article 7 of the Statute of the Portuguese General Labour Inspectorate (Portuguese Government, 2000a) and in the paragraphs 2 and 3 of article 564 of the Portuguese Labour Code (Portuguese Parliament, 2009d).

It is an inspection procedure which is usually prepared at the ACT competent local branch office. It can be a rather demanding inspection procedure, especially when it involves large number of workers. It does not necessarily require the completion of an inspection visit, if the facts can be supported or proven by documents. Nevertheless, this inspection procedure usually results from inspection visits and requires additional inspection visits to collect evidence (e.g. work contracts, working time and overtime records, paycheck receipts).

5.2.3.2.2.5.6 Notices to cease immediately the activity provided by minors

The labour inspectors must notify the employer to terminate immediately the activity provided by a minor, when he detects: a) The provision of work by a minor who has not yet completed the minimum age (16 years old), have not completed compulsory education and has no adequate physical and mental capabilities, as provided for in paragraph 1 of article 68 and in article 83 of the Portuguese Labour Code (Portuguese Parliament, 2009d); and b) The provision of activity by a minor, in works which, by its nature or the

conditions in which they are provided, are detrimental to his physical, psychic and moral development and, as such, are prohibited or conditioned, in particular with regard to activities, agents, processes and working conditions prohibited or conditioned to minors, predicted in articles 61 to 72 of the Law No. 102/2009, of 10 September, which regulates the legal framework for the promotion of health and safety at work (Portuguese Parliament, 2009a), as provided for in the paragraph 2 of article 72 and in article 83 of the Portuguese Labour Code (Portuguese Parliament, 2009d).

The notice to cease immediately the activity provided by minors has to include, *inter alia*: the identification of the employer and the respective legal representative; date, time and place of the verification of the infraction; full identification of the minor and his age and education; description of concrete activity that was being performed by the minor; supportive regulatory framework of notice; and the clear information to the employer that if he does not cease immediately the activity provided by a minor, he will incur in the crime of qualified disobedience, as provided for in article 83 of the Portuguese Labour Code (Portuguese Parliament, 2009d) and in paragraph 2 of article 348 of the Portuguese Penal Code (Portuguese Government, 1995b).

It should be noted that the practice of the facts described above, in addition to constitute very serious offenses, as foreseen in article 67 of the Law No. 102/2009, of 10 September, which regulates the legal framework for the promotion of health and safety at work (Portuguese Parliament, 2009a), are also likely to set up the practice of the crime of misuse of minor labour, provided for and punished under article 82 of the Portuguese Labour Code (Portuguese Parliament, 2009d).

In this context, when a labour inspector detects the facts referred to above, and without prejudice to the elaboration and delivery to the employer of the notice to cease immediately the activity provided by minors, he has to raise the competent infraction notices, prepare and submit to the competent public prosecutor the corresponding criminal participation (along with the corresponding infraction notices) and, at the same time, he also has to send the corresponding participation of the facts to the Commission for the Protection of Children and Young People of the municipality in which such practice occurred.

In spite of being an inspection procedure that can be applied during the inspection visit, this notice to cease immediately the activity provided by minors is a very resources demanding procedure, as it requires several additional procedures and inspec-

tion visits. Fortunately, it is a procedure rarely applied, to the extent that nowadays it is rare to detect the misuse of minor labour.

5.2.3.2.5.7 Notices to other entities

Moreover, labour inspectors should apply the notice to other entities to participate to other authorities the facts that they took knowledge of, but in which the jurisdiction falls under the responsibilities of other public authorities. This is the case, for instance, of the participations to other competent authorities and the participations to the Public Prosecutor.

The notices to other entities should include the following elements: legal norms under which it is performed; name and position of participant; facts constituting the infringement and legal norms violated; day, time, place and circumstances in which the violation was committed; subjective element, susceptible to allow assessing the degree of fault or fraud of the agent; the identification of agents (name/corporate name, tax identification number, address/registered office, legal representatives, etc.); and the evidence that the participant has and the identification and residence of witnesses.

5.2.3.2.5.7.1 Participation to other competent authority

It is a formal procedure, through which the labour inspectors communicate to other entity the irregular situations detected and falling within the scope of that entity's competencies and responsibilities, as provided for in paragraph 1-i) of article 10 of the Statute of the Portuguese General Labour Inspectorate (Portuguese Government, 2000a).

Such participations include, for example, the participation to the Institute of Employment and Vocational Training, of the activities of temporary work or private agency placement by unauthorized companies; the participation to the Food and Economic Safety Authority, of the exercise of an regulated economic activity by unlicensed companies or failure to comply with the applicable law on food safety; the participation to the Directorate General of Health of unauthorized companies or professionals which pursuit the activity of providing services of health or medicine at work; the participation to the Institute of Public Markets, real estate and construction, pursuit of the activity of construction or purchase and sale or lease of real estate by non-licensed companies; the participation to the National Civil Protection Authority, the infractions verified on the

legislation regarding the fire safety in buildings; the participation to the Public Security Police, the pursuit of the activity of private security by non-licensed companies; etc.

The participation to other competent authority does not necessarily require the completion of an inspection visit, although it usually results from the infractions verified during the inspection visits, and is habitually prepared in the ACT local branch office.

5.2.3.2.2.5.7.2 Participation to the Public Prosecutor

According to the article 241 and 242 of the Portuguese Code of Criminal Procedure (Portuguese Government, 1987), all the public officials (including, obviously, the labour inspectors and other ACT staff), are obliged to participate to the Public Prosecutor all the crimes that they take knowledge of in the performance of their duties or because of them.

This assumes special relevance in what respects to:

1. The crimes foreseen in the Portuguese Labour Code (Portuguese Parliament, 2009d), namely: misuse of the activity provided by a minor (article 82); qualified disobedience for not ceasing immediately the activity provided by a minor (article 83); violation of trade union independence or autonomy or practice of discrimination (article 407); union share retention (article 459); failing to comply with a notification to submit documents and other relevant records or for hiding, destroying or corrupting a document or other record that has been requested (article 547); and criminal liability of the employer in the event of closure of the undertaking or establishment (article 316), lack of prompt payment of the remuneration (article 324), violation of strike rights (article 543) and practice of lock-out (article 545).
2. Legal norms of the Portuguese Penal Code (Portuguese Government, 1995b) with labour relevance, such as: mistreatment (article 152-A); violation of safety rules (article 152-B); kidnapping (article 158); slavery (article 159); trafficking in persons (article 160); sexual coercion (article 163); rape (article 164); pimping (article 169) and pimping of minors (article 175); abuse of trust (article 205); swindling relative to work or employment (article 222); infringement of rules of construction, damage to facilities and disruption of services (article 277); and disobedience or qualified disobedience. The latter occurring in situations where, besides the ones referred to above, the employer fails to comply with a suspension notice, as provided for in the article 348 of the Portuguese Penal Code

(Portuguese Government, 1995b) in conjunction with the provisions of the paragraph 1-d) of article 10 of the Statute of the Portuguese General Labour Inspectorate (Portuguese Government, 2000a) and of the paragraph 1-c) of article 10 of the procedural regime applicable to the infringement proceedings concerning the administrative offenses to labour and social security regulations, approved by the Law No. 107/2009, of 14 September (Portuguese Parliament, 2009c).

The participations to the Public Prosecutor often result from the facts that the labour inspectors verify during the inspection visits and are usually prepared in the ACT territorial competent local branch office. Notwithstanding the above, these participations do not require the performance of any inspection visit as long as the participant has all the facts and respective evidence.

Moreover, and in addition to the aforementioned participations to the Public Prosecutor, the labour inspectors can also participate to the Public Prosecutor the misuse of the service contract in a subordinate employment relationship, as further explained below.

5.2.3.2.2.5.8 Procedures concerning the misuse of service contract

The procedures concerning the misuse of the service contract in subordinate employment relationships are aimed at promoting the urgent regularization of the situation where employers benefit from the provision of work apparently in an autonomous manner but in conditions that features an employment contract, in order to avoid or circumvent the compliance with the labour, tax and social security regulations, especially in the case of bogus self-employment.

These procedures, which were established by the Law No. 63/2013 in 27 August and entered into force only in the first of September of 2013 (Portuguese Parliament, 2013a), include: notice to regularize the misuse of the service contract in a subordinate employment relationship; infraction notice due to the misuse of the service contract in a subordinate employment relationship; and the participation to the Public Prosecutor of the misuse of the service contract in a subordinate employment relationship.

These are procedures that involve, as a general rule, the completion of more than one inspection visit.

5.2.3.2.2.5.8.1 Notice to regularize the misuse of service contract

If the labour inspector verifies the existence of an apparently autonomous activity provision, but in similar conditions as the employment contract, as described in article 12 of the Portuguese Labour Code (Portuguese Parliament, 2009d), he should notify the employer to regularize the situation, showing documents evidencing the acknowledgment of the existence of an employment contract for an indefinite period from the date of commencement of the employment relationship, or to present his defense within 10 days, as provided for in paragraph 1 of article 15-A of the procedural regime applicable to the infringement proceedings concerning the administrative offenses to labour and social security regulations, approved by the Law No. 107/2009, of 14 September (Portuguese Parliament, 2009c).

5.2.3.2.2.5.8.2 Infraction notice due to the misuse of service contract

When the labour inspector considers that the conditions are met for the adoption of an infraction notice to sanction the provision of activity in an apparently autonomous way but in terms of an employment contract, regardless of whether the employer regularizes the situation, he should raise an infraction notice for the misuse of the service contract in a subordinate employment relationship, as foreseen in paragraph 1 of article 17 of the ILO convention No. 81 (ILO, 1947); in paragraph 1 of article 22 of the ILO convention No. 129 (ILO, 1969); in paragraph 1 of article 6 and in paragraph 1 of article 7 of the Statute of the Portuguese General Labour Inspectorate (Portuguese Government, 2000a); and in paragraph 1-d) of article 10, paragraphs 1 and 3 of article 13 and paragraph 1 of article 15-A of the procedural regime applicable to the infringement proceedings concerning the administrative offenses to labour and social security regulations, approved by the Law No. 107/2009, of 14 September (Portuguese Parliament, 2009c).

In addition to the elements to be included in any infraction notice, the infraction notice due to the misuse of the service contract in a subordinate employment relationship should also contain the verified facts indicating the existence of an employment relationship, with particular emphasis on the elements proving the legal subordination.

5.2.3.2.2.5.8.3 Participation to the Public Prosecutor of the misuse of service contract

When the situation of the employee concerned is not regularized within the 10 given days, the labour inspector must participate to the Public Prosecutor of the area of residence of the employee, within five days from the deadline mentioned, the misuse of the service contract in a subordinate employment relationship, for purposes of instituting the urgent action to recognize the existence of an employment contract, as provided for in paragraph 3 of article 15-A of the procedural regime applicable to the infringement proceedings concerning the administrative offenses to labour and social security regulations, approved by the Law No. 107/2009, of 14 September (Portuguese Parliament, 2009c).

This participation to the Public Prosecutor should describe the relevant facts and be accompanied by all evidence collected.

Furthermore, the above mentioned action to recognize the existence of an employment contract suspends, until its decision has become final, the administrative infringement proceedings generated by the infraction notice due to the misuse of the service contract in a subordinate employment relationship.

5.2.3.2.3 Instructing labour administrative infringement proceedings

The ACT local branches labour inspectors and technical officials are expected to instruct the labour administrative infringement proceedings (generated by the infraction notice), in accordance with the general legal regime of the administrative offenses (Portuguese Government, 1982), the procedural regime applicable to the infringement proceedings concerning the administrative offenses to labour and social security regulations (Portuguese Parliament, 2009c) and the ACT's practical guide on labour administrative infringement proceedings (ACT, 2016f).

Figure 5 illustrates the ACT's labour administrative infringement proceedings.

The administrative infringement proceeding is a very complex and resources consuming legal process. It is intended to ascertain the facts, discover the truth and support the decision of the administrative authority (ACT).

In essence, it integrates all the procedural acts necessary for the exercise of the defendant's defense, all the proceedings required by the defendant, as well as others

which, even unofficially, are proved necessary for the proper investigation of the factual reality in which will be based the administrative decision (ACT, 2016f).

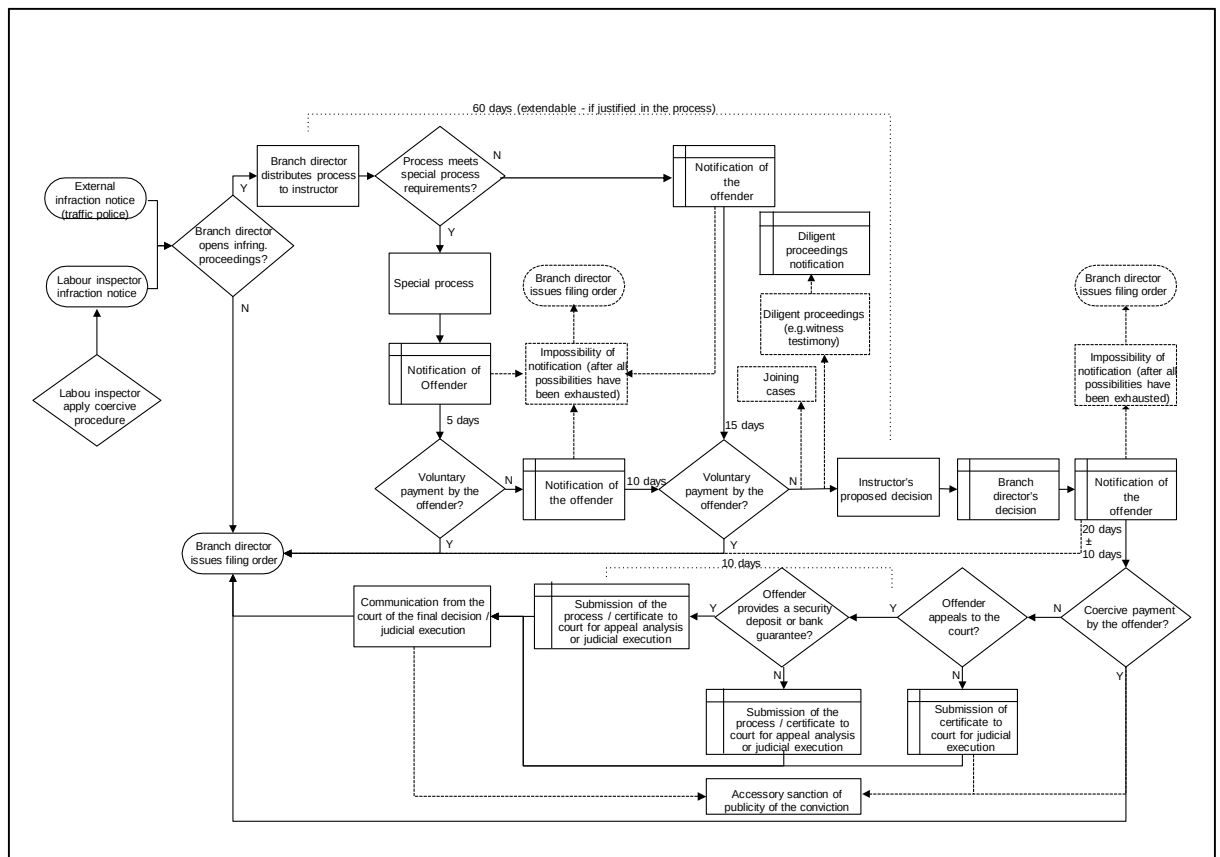


Figure 5 - ACT's labour administrative infringement proceedings flowchart

Source: Adapted from ACT (2016f:75)

In general, the labour administrative infringement proceedings have their origin in the infraction notices raised by labour inspectors, regarding labour regulation offenses under their legal competence. However, they can also result from infraction notices raised by other authorities' officials (such as the traffic police officials), regarding other infractions to labour regulations that they verify (e.g., infractions to the labour norms regulating driving and rest times in road transport).

The labour administrative infringement proceeding begins with the distribution of the process to the instructor (which has to be either an ACT labour inspector or a technical official) by the director of the ACT competent local branch and must be completed within 60 days. This period can be successively extended for equal periods, in duly substantiated cases formally justified in the process itself (ACT, 2016f).

The instruction of the infringement proceeding ends with the decision proposal prepared by the instructor of the process, with a view to enable the local branch director to

make the decision in the proceeding, which has to be notified to the subjects involved in the process. This director decision can be a document which consists of a mere declaration of agreement with the draft decision prepared by the instructor.

The opening of the infringement proceeding and its distribution to the instructor, as well as all the subsequent procedures are recorded in the computer system, which also alerts the instructor of its distribution as well as of the approximation of the legal time limits for the execution of the various procedures.

In the labour administrative infringement proceedings the count of the statutory deadlines follows the provisions of the code of criminal procedure, so the term is continuous, i.e. not suspended on Saturdays, Sundays and holidays, or during the judicial vacations.

Within the labour administrative infringement proceedings, the notifications are made to the headquarters or domicile of recipients. Pending the procedure, all notifications of the process are carried out by means of a simple letter. They can also be made by telefax or via email, whenever the defendant has used this means to contact the ACT or his represented by a lawyer. In the latter case, the notifications can be only made to the lawyer. Nevertheless, the defendant notification of the infraction notice or of the labour administrative infringement proceedings decision should be made to him, through registered letter with reception confirmation (ACT, 2016f).

Moreover, the payment by the defendant to ACT of the fines, workers ' claims, social security contributions and administrative costs can be made voluntarily (after the notification of the infraction notice and during the labour administrative infringement proceedings until the decision), coercively (after the notification of the labour administrative infringement proceedings decision and within the respective legal deadline) or via court (if the defendant appealed to court against the decision of the administrative authority or the ACT sent the process to the court for review or execution).

5.2.3.2.3.1 Special infringement proceeding

In the case of minor or serious offenses with legal minimum value equal to or less than 10 Units of Account (1 UC = €102), the defendant is given the possibility to pay the fine with a reduction of 25% of the minimum legal amount applicable, if he has not been convicted for breaking labour laws in the last 5 years.

According to this special infringement proceeding, the offender and those jointly liable for the payment of the fine are notified of the facts charged, legal provisions violated and the possibility of paying the the fine with the 25% reduction if, within a maximum period of 5 days after being notified: a) the fine is payed; and b) the defendant fulfills the omitted duty (if still possible).

If the defendant complies with the omitted duty and pays the fine within the aforementioned time limit, the case is filed and equals to a definitive conviction.

If the defendant complies with the omitted duty, but does not pay the fine, or fails to comply with the omitted duty (if still possible), the special infringement proceedings transits for common infringement proceeding, with the following adjustments: a) the deadline for voluntary payment of the fine, submission of written answer or personal appearance to present reply is reduced to 10 days; and b) the time limit for the infringement proceeding instruction completion is reduced to 30 days (ACT, 2016f).

5.2.3.2.3.2 Common infringement proceeding

The common labour administrative infringement proceeding applies to situations which does not meet the conditions for the application of the special process. It also applies in cases where the law itself foresees that the special process flows into common process, with the necessary adjustments.

In the common infringement proceeding, the defendant and those jointly liable for the payment of the fine are notified of the infraction notice, through registered letter with reception confirmation. Besides a copy of the infraction notice and respective annexes, this notification should be accompanied by the instructions for payment and a copy of the individual record of offenses (in the latter case, when considering recurrence behaviors or the application of accessory penalties). If it is not possible to notify through registered letter with reception confirmation, police cooperation should be sought for this purpose. If the latter proves ineffective, it should be promoted the personal contact notification by the ACT. In the case of total impossibility of notification, the process is filed by impossibility of notification, without prejudice of reopening if new elements are known to allow notification of the defendant (ACT, 2016f).

Once regularly notified the infraction notice, several situations can arise, namely: a) voluntary payment of the fine; b) defense presentation; and c) lack of payment and defense (ACT, 2016f).

The voluntary payment of the fine by the defendant or by those jointly liable is admitted at any time of the proceeding until its final decision, except in the cases of very serious offenses committed with willful and misdemeanors regarding the lack of delivery of maps, reports, or other documents or for lack of mandatory communications. In these last cases, the voluntary payment of fines can only be effected if delivered the missing documents. The voluntary payment equals a final conviction and entails the termination of the proceedings, unless an accessory sanction is applicable to the offense, in which case proceeds restricted to its application. In the cases where the debts to workers and/or to social security have not been paid in conjunction with the voluntary payment of the fine, the proceeding is filed in the same, but ACT communicates to employees and/or to social security the calculated value of those debts, with an indication that those amounts constitute an executive and enforceable title.

If the defendant or those jointly liable choose to present defense, they can do so by submitting a written answer or through personal appearance in the competent local ACT branch to submit reply, on the day set for hearing. In this latter case, the statements of the defendant or of those jointly liable are reduced to writing and signed by all those present. Moreover, the démarches requested by the defense should be carried out, unless they are patently delaying tactics. The type of evidence admitted under the labour administrative infringement proceedings are the documentary and testimonial. It can, however, be allowed other evidence, as long as it's not obvious that the evidence required is irrelevant or superfluous, the evidence is inadequate or its application has merely dilatory purposes. In the circumstances in which it is effected the voluntary payment and, at the same time or subsequently, presented a written answer, the voluntary payment of fines implies the conviction of the accused and determines, by itself, a dismissal, except in what concerns the application of an accessory sanction, as already mentioned.

In the cases where the defendant or those jointly liable do not pay the fine voluntarily nor present a defense within 15 days after the notification of the infraction notice (or 10 days in the case of processes that followed via special process), the procedure follows to the preparation of the decision proposal. In this case, the description of the facts charged, the evidence and the circumstances relevant to the decision is made by simple reference to the infraction notice.

In general, the labour administrative infringement proceeding decision proposal, prepared by the instructor, must include all the elements of fact and law necessary to the

decision, namely: identification of the subject responsible for the infringement; description of the facts charged, with indication of the evidence obtained (which may be made by reference to the infraction notice, in the absence of a defense presentation); indication of the legal norms according to which applies the sanction and the grounds for the decision; proposed application of fines and accessory sanctions (if applicable); and, where appropriate, the order of payment of the debts due to workers, to be effect within the same time limit laid down for the payment of the fine. The decision proposal appreciates and values all evidence collected during the proceedings, in accordance with the rules of the experience and free conviction of the instructor, considering proven the material facts contained in the infraction notice, while its authenticity or the accuracy of its content are not called into question. Furthermore, in determining the amount of the fine, it should be taken into account the following aspects: severity of the offense; degree of guilt of the agent; economic situation of the agent; economic benefit resulting from the offense; measure of non-compliance with a warning from the labour inspectorate; any use, by the agent, of coercion, falsification, simulation or any other fraudulent means; and the violation of OSH regulations, in which case are also to be taken into account the following aspects: the violation of the general principles of prevention; the persistence or transience of the infraction; the number of workers potentially affected; and the measures and instructions adopted by the employer to prevent risks (ACT, 2016f).

Once the decision proposal is submitted, the director of the local competent ACT branch is expected to decide whether to archive the proceedings or to notify the offender and those jointly liable of the decision which imposes fines and accessory sanctions (if applicable). This decision has to be notified both to the defendant (and those jointly liable) and to his lawyer, through registered letter with reception confirmation.

After the notification of the decision of the administrative authority, the defendant (and those jointly liable) must proceed to the payment of the fine and the administrative costs of the proceedings (as well as the credits due to workers, if applicable) within 10 days after the finality of decision, that is, during the period of 20 days after the notification (period during which the defendant and those jointly liable can appeal to the court for the judicial review of the administrative authority decision). If the fine is not paid in legal terms, the decision of the administrative authority assumes the nature of executive title. Once the deadline of 20 days (after the notification of the decision) has expired without the fine is paid or security has been given for the purposes of judicial review, the corresponding debt certificate should be sent to the representative of the pub-

lic prosecutor of the Court, for the purpose of execution, accompanied by the process (e.g. infraction notice, decision and attestation of its notification). The decision containing the order for payment of amounts owed to the employee serves as a basis for the execution. The process will wait for the result at the local competent ACT branch (ACT, 2016f).

5.2.3.2.3.3 Judicial review of the decision of the administrative authority

Once received the notification of the labour administrative infringement proceeding decision, the defendant has the period of 20 days for the submission of the above mentioned judicial review.

This judicial review has to be presented at the local competent ACT branch, addressed to the Labour Court territorially competent taking into account the place where the infraction took place, and contain allegations, findings and evidence to be produced. It can have suspensive effect on the decision of the administrative authority or only devolutive effect. For the judicial review to stop the effects of the decision of the administrative authority, it is necessary for the defendant to deposit the amount of the fine and administrative costs in a Bank, in favour of the ACT, or to provide a bank guarantee in the mode ‘on first demand’ (ACT, 2016f).

Despite the suspensive or devolutive nature of the judicial review requested, and before sending the case to the Prosecutor at the Labour Court territorially competent, if the applicant is right, even if partially, the ACT can revoke (wholly or partially) the decision, which may involve the repetition of the previous steps of the proceedings.

The ACT can also submit allegations. These, wherever possible, shall contain the following: relevant case-law, in particular, decisions of first instance; evidence, in particular, testimonial; proposal to the Prosecutor to oppose the judge decision through simple dispatch and manifestation of the interest of the ACT to participate in the trial hearing.

After sending the case to the courts, the conduction of the proceedings turns to be of exclusively competence of the public prosecutor, leaving the ACT with no legal power over the proceedings. In this judicial stage of the administrative infringement proceedings, the ACT can only participate in the trial hearing or comment in writing on the relevance of the resource, to be promoted by the Public Prosecutor, regarding an eventual ruling of dismissal, absolution or change of conviction (ACT, 2016f).

5.2.3.2.4 Providing information and technical advice services

The ACT local branches have also to provide information and technical advice to workers, employers and their representatives, about the best way to comply with the labour relations and OSH regulations, as provided for in the paragraph 2 of article 17 of the ILO convention No. 81 (ILO, 1947), paragraph 2 of article 22 of the ILO convention No. 129 (ILO, 1969), paragraph 1 of article 5 and paragraph 1-a) of article 10 of the Statute of the Portuguese General Labour Inspectorate (Portuguese Government, 2000a) and paragraph 2-b) of article 2 of the organic law of the ACT, approved by the Regulatory Decree No. 47/2012, of 31 July (Portuguese Government, 2012c).

This information and technical advice are provided either at the workplaces or outside of them, in the form of verbal information (especially in the course of inspection visits), written information (by mail or e-mail), as well as through face-to-face or telephone information services, daily provided in each local ACT branch.

The information and technical advice delivered during inspection visits are exclusively provided by labour inspectors, while the information and technical advice supplied at the local ACT branches (such as the written information and advice or the ones provided through the face-to-face or telephone information services) can also be provided by technical officials or technical assistants.

Considering the resources consumed by each person informed, the information and advice provided during the inspection visits are those that consume more resources followed, in this order, by the written information service, face-to-face information service and telephone information service.

5.2.3.2.5. Developing information actions and awareness-raising campaigns

Besides providing information and technical advice on the best way to comply with labour regulations, ACT local branches are also expected to develop information actions and awareness raising campaigns, as provided for in the paragraph 2-b) of article 2 of the organic law of the ACT, approved by the Regulatory Decree No. 47/2012, of 31 July (Portuguese Government, 2012c).

The development of information actions and awareness raising campaigns concerns the organization, in partnership with the appropriate social partners and other institutional partners of informations campaigns designed to sensitize employees, employers,

their representatives and citizens in general, for topics relating to working relations and conditions. Typically, they involve all (or the relevant) local branches of the ACT, include 3 axes of action (information and public awareness, self-regulation and inspection) and are consubstantiated in various activities, including seminars, workshops, exhibitions and inspection visits carried out by the ACT labour inspectors. In 2013 the ACT carried out various information and awareness-raising campaigns, for example, relating to the transnational mobility of workers, safety and health at work in the agricultural and forestry sectors, safety and health in the work in confined spaces and improvement of the working conditions in the footwear industry.

Other information and awareness raising campaigns in which the ACT local branches are usually involved is the ‘Safe start-education for prevention - back to school’ Campaigns. It comprises carrying out information and sensitizing activities on OSH for pupils at schools across the country (272 information actions in 2013).

Other information and awareness raising activities involve, for instances: the official celebrations of the World and National Day (28 of April) of Prevention of Safety and Health at Work (for example, in April of 2013, 267 information and awareness raising activities were held across the country, including 42 seminars, 187 dissemination actions and 38 exhibitions subordinate to the National Day of Prevention); and the OSH information activities performed by the ACT as EU-OSHA Focal Point. The latter normally includes the performance of several initiatives by the ACT local branches. For example, in 2013, it encompassed: actions for the dissemination of the EU-OSHA European campaign 2012-2013 ‘Together in the prevention of occupational risks’, through 35 seminars and workshops; 49 dissemination actions of the European Photography Prize of the European campaign 2012-2013; 13 dissemination actions of the Prize of the Leipzig Cinema Contest, promoted by EU-OSHA; distribution of 3000 copies of the ESENER report to SMEs during seminars; dissemination of the report of the Observatory on Mental Health in Europe, through 4 seminars; and performance of 6 actions of information on safety and health at work in the accommodation and food service sector.

Considering that these information actions and awareness raising campaigns allow covering a large number of recipients simultaneously, they are proving to be a particularly cost-effective tool to provide information and advices to workers, employers, respective representatives and the general public.

5.2.3.3 ACT main resources

In order to fulfill his duties and ensure the accomplishment of its mission, the Portuguese Government provides ACT with financial, human and material resources (e.g. facilities, cars and information and communication systems and technologies).

5.2.3.3.1 Financial resources

The ACT does not have financial autonomy. As provided for in article 8 of its organic law, ACT revenues come from the revenue assigned to it by the State budget and the social security budget, as well as from its own resources.

The latter come from the amounts charged for the provision of services within the framework of its tasks; the proceeds from the sale of publications and works edited by ACT; the values charged for entry or registration in courses, seminars and training actions and other activities of the ACT or of his initiative in collaboration with other entities; and the proceeds resulting from the fines collected within the labour administrative infringement proceedings, in the proportion defined in the law, even if collected through the courts (Portuguese Government, 2012c).

Table 11 presents the evolution of the ACT budget's appropriations, corrected and net of captives and of integration of balances carried over, for the years 2009 to 2016.

Thousands of euros									
Funding Source	2009	2010	2011	2012	2013	2014	2015	2016	% Variation 2009-2016
Own Revenue	6,772.4	5,939.4	7,693.4	6,522.1	5,208.7	6,522.1	6,050.3	4,470.8	-34.0
State budget	11,855.5	12,577.3	9,633.1	6,568.2	6,607.3	4,785.6	4,470.8	6,101.0	-48.5
Social security budget	33,337.3	37,982.3	24,881.0	20,771.6	21,146.9	21,751.3	20,020.3	20,208.0	-39.4
Total	51,965.2	56,499.0	42,207.5	33,861.9	32,962.9	33,059.0	30,541.4	30,779.8	-40.8

Table 11 – Evolution of the ACT budget's appropriations corrected and net of captives and balances brought forward (period 2009 to 2016)

Source: Data of the ACT

The analysis of Table 11 allows the verification that the ACT budget's appropriations, corrected and net of captives and balances carried over, have suffered, between the year of 2009 and 2016, a substantial break, of about 41%, corresponding to about €21.2M. Indeed, during this period, there has been a reduction of about 49% in appropriations from the State budget, a decrease of about 39% in appropriations from the so-

cial security budget and a decrease of about 34% in own resources (particularly from the fines imposed).

The remarkable reduction to which the successive annual budgets of the ACT have been subjected to has compromised ACT's ability to act decisively and puts into question the pursuit of its mission, of promoting the improvement of work conditions, as already stressed by the European Parliament's Resolution No. 2013/2112(INI), of 14 January 2014 (European Parliament, 2014).

5.2.3.3.2 Human resources

To ensure the fulfillment of its mission, the ACT is also endowed with a body of around 800 professionals, distributed by the following categories: directors (3 senior directors and 40 intermediate managers of the 1st and 2nd degrees - 12 of which of the ACT headquarters departments; the other 28, all labour inspectors, of the 32 ACT local branches), 307 labour inspectors, 228 technical officials, 11 computer technicians, 176 technical assistants and 39 operational assistants (ACT, 2016d).

The age structure of the employees of the ACT was, in 2015, between 25 and 69 years of age, with the average at 48 years.

The age group with the highest frequency was of 40 to 44 years of age, representing about 22% of the employees.

On the other hand, regarding the seniority of the workers at the end of 2015, the average seniority was 19 years, being the most representative seniority levels the ones between the 5 and 9 years (14.3%), between 10 and 14 years (13.7%) and between 15 and 19 years (12.6%), corresponding to a total of 326 workers, representing about 40.5% of the total number of employees. As to its distribution by gender, about 73% of the ACT employees in 2015 were female. With regard to levels of education, the more representative in the ACT is the university academic degree (approximately 64%), followed by the 12th year of schooling (about 17%) and the master's degree (about 6%) (ACT, 2016d).

Table 12 illustrates the evolution of the number of human resources of the ACT, by professional category, between 2009 and 2015, as well as the evolution of the corresponding ratio of number of employees served by labour inspector.

The analysis of Table 12 allows noting that during the period considered, the human resources of the ACT presented a global reduction of about 16%. It shows a sharp re-

duction in the number of labour inspectors (24%) and a more pronounced drop (of about 35%) at the level of the technical assistants and operating assistants.

Description	2009	2010	2011	2012	2013	2014	2015	% Variation 2009-2015
Directors	44	43	44	38	32	43	43	-2.3
Labour inspectors (on effectiveness of functions)	402	384	371	359	343	308	307	-23.6
Technical officials	172	163	222	214	210	214	228	32.6
Computer technicians	8	9	9	9	9	11	11	37.5
Technical assistants	272	249	250	231	213	166	176	-35.3
Operational assistants	60	50	44	42	37	28	39	-35.0
Total	958	898	940	893	844	770	804	-16.1
Employed population (thousands)	4,968.6	4,898.4	4,740.1	4,546.9	4,429.4	4,499.5	4,548.7	-8.5
Ratio of number of workers per labour inspector	12,360	12,756	12,777	12,665	12,914	14,609	14,817	18.1

Table 12 – Evolution of the human resources of the ACT by professional category (period 2009-2015)

Sources: ACT (2010, 2011a, 2012, 2013a, 2014a, 2015d, 2016d) and PORDATA (2016)

The most worrying aspect, however, is that the number of labour inspectors has fallen 24% within this period: from 402 labour inspectors in effectiveness of functions in 2009 to 307 labour inspectors in 2015. This break in the number of inspectors has led, on the other hand, to an increase in about 18% of the ratio of the number of employees served by the labour inspector. In fact, the number of workers served by labour inspector rose from 12,360 workers per labour inspector in 2009 to 14,817 workers per labour inspector in 2015. This means that, in Portugal, in average terms, each labour inspector serves more 4,595 workers (around more 48%) than the 10,000 workers per labour inspector that the ILO recommends, as mentioned earlier, for countries with industrial market economies such as Portugal.

The lack of human resources of the ACT and the need for its reinforcement, in order to improve the effectiveness of its intervention, has long been recognized, by the social partners, by the Portuguese Government and by the Portuguese Parliament. It is important to highlight, in this regard: the Agreement on Strategic Concertation 1996/1999, signed by the Government and the social partners within the framework of the Standing Committee on Social Dialogue of the Portuguese Economic and Social Council (CES), in 20 December 1996, in which it was agreed to strengthen the means of intervention of the Labour Inspectorate, empowering it with more and better human and material resources (CES, 1996:99); the Commitment to Growth, Competitiveness and Employment, signed by the Government and the social partners within the framework of the Standing Committee on Social Dialogue of the CES, in January 2012, where was defended the need to strengthen the instruments at the disposal of the ACT (CES,

2012:48); the Resolution of the Portuguese Parliament No. 13/2013, of 25 February, for the relaunch of employment and for good practices of labor contracting, which recommended the Government to maintain the policies of strengthening the means and instruments available to the ACT (Portuguese Parliament, 2013b); and the Resolution of the Portuguese Parliament No. 46/2013, of 4 April, for the non-discrimination against women, which recommended to the Government to ensure the adequacy of the human resources of the ACT (Portuguese Parliament, 2013c).

It is expected that the insufficiency of human resources of the ACT, especially at the level of labour inspectors, may be toned down in the medium term. Not only with the input of 37 labour inspectors trainees during the second half of 2017, that will be predictably nominated definitely as labour inspectors, of the senior labour inspector career of the ACT, in fall 2018 (although at the expense of losing some ACT technical officials and technical assistants, which may also be incorporated as labour inspectors, following their application for that job vacancies)²², but especially with the predictable entry of another 80 labour inspector trainees by the end of 2018 (that will be predictably nominated by the end of 2019)²³.

5.2.3.3 Facilities

In pursuit of its mission, the ACT has facilities where both its headquarters (two buildings and a warehouse in Lisbon) and its 32 local branches are installed (33 buildings - insofar as the local branch of Guimarães has an extension in Vila Nova de Famalicão -, and some other smaller facilities, for storage and archive).

The ACT does not have own assets. Some of the facilities that are used are leased to private owners or to other public bodies, to which the ACT pays the respective rents; others belong to the State and are managed by the Directorate-General of Treasury and Finance, to which the ACT pays a compensation, in order to comply with the principle of onerosity, established by the Ministerial Ordinance No. 278/2012, of 14 September, which regulates the implementation of the onerosity principle in the Portuguese Public Administration (Portuguese Government, 2012b).

²² Following the opening of the internal contest for admission into the labour inspector internship, with a view to completing 37 jobs in the category of labour inspector of the senior labour inspector career of the ACT, whose opening warning was published on 21 May 2016 (ACT, 2015i).

²³ Following the opening of the external contest for admission into the labour inspector internship, with a view to completing 80 jobs in the category of labour inspector of the senior labour inspector career of the ACT, whose opening warning was published on 6 December 2016 (ACT, 2016g).

The premises of the local branches are fundamental to ensure the fulfilment of the mission of the ACT, by ensuring proximity to the subject of labour relations and their representatives.

In these facilities the following activities, among others, are developed:

1. Planning and programming of the inspection activities and of the OSH promotion activities to be carried out;
2. Daily provision of information and technical advice services in person, written and by telephone, to workers, employers and their representatives;
3. Analysis of documentation and of events that took place in the course of inspections, inquiry of workers, employers and witnesses, drafting and computer record of inspection procedures that have not been prepared in the course of inspections carried out (e.g. infraction notices, notices to establish debts to workers and/or to social security) and preparation, registration and submission of the reports of the inspection processes;
4. Analysis of documentation and other evidence relating to work-related accidents investigations, inquiry of the victims (if possible), coworkers, superiors, representatives of the employer and witnesses and drafting, computer record and submission of the respective reports;
5. Instruction of labour administrative infringement proceedings (e.g. documentation analysis; inquiry of defendants, those jointly liable and witnesses; preparation and sending of notifications; drafting of proposals for decision, etc.);
6. Meeting with collective representation structures of workers and employers;
7. Organization and holding of seminars, workshops and awareness-raising and information actions;
8. Holding training actions for ACT officials.

5.2.3.3.4 Service cars

Cars are another important resource for the ACT local branches, as they are needed for the transportation of labour inspectors and other ACT officials in the performance of their duties, especially in zones outside urban areas or in places poorly served by public transport. This is particularly true in local branches with larger jurisdiction areas or lower employed population density per square kilometer (such as Beja, Bragança, Évora, Portalegre and Castelo Branco).

In 2016 the ACT has a total of 156 light vehicles (154 light passenger vehicles and 2 light mixed vehicles). The local branches account for 147 light passenger vehicles, including 5 jeeps and 7 pickups.

From the fleet used by ACT, 116 vehicles belong to the State vehicle park, managed by Espap (a shared services company of the State) and the rest (40 vehicles) were recently acquired, in 2015, through operating rental contracts of long duration (for 4 years).

The ACT fleet has an average obsolescence of about 16 years and an average mileage around 330,000 kms.

5.2.3.3.5 Information and communication systems and technologies

The information and communication systems and technologies are other important resources to ensure the effectiveness and efficiency of the ACT.

They are considered essential tools for ensuring, in particular, the general prevention processes of non-compliance and its detection, the planning, execution and monitoring of the inspection and OSH promotion activities, the instruction and accompaniment of the sanctioning procedures and the proper monitoring and control of the results of the measures taken.

The information and communication systems and technologies involves, not only the information systems of the ACT (applications, databases and intranet and internet portals) but also the communications (voice and data) network and infrastructure, as well as the servers, desktops, laptops and respective peripheral equipments.

ACT information systems, namely in what concerns the computer applications that support the inspection activity and the OSH promotion activities, as well as the data network speed and bandwidth, are of paramount importance to allow ACT professionals to perform their duties (either in-house or during the inspection or OSH promotion visits) more efficiently and to monitor and evaluate its results.

Moreover, the desktops and laptops are also absolutely indispensable work instruments to carry out the tasks assigned to all professionals in the ACT. In the particular case of labour inspectors, these have laptops, so as to enable the remote and real-time access, especially during the inspection visits, to the inspection activity applications and support tools, available in the information systems of the ACT, as well as the remote and real-time access to the social security database.

Mobile phones are another important work instrument, especially for labour inspectors, not only for safety reasons, but also for the collection of photographic and video records evidence.

5.2.3.4 Operational costs

The ACT operating costs and, by extension, those resulting from the activities carried out by its local branches, are mainly staff costs, which have the following structure: wages (51.5% of the total operational costs); civil servants pension system (11.8%); inspection action supplement received by labour inspectors (5.9%); vacation allowance (4.8%); Christmas bonus (4.4%); social security (3.7%); meal allowance (2.6%); per diems (0.65%) and overtime (0.22%). Taken together, they currently represent about 87% of the total operational costs of the ACT.

Notwithstanding the enormous weight assumed by the personnel costs in the operational cost structure of the ACT, is worth mentioning other costs which, in spite of not having such weight, still have some expression: the rental costs of premises (approximately 3.6% of total operating costs), electricity and water consumed on the premises (1.45%), premises cleaning services (1.2%), mail service (0.75%), facilities security services (0.62%), office supplies (0.42%) and service cars fuel consumption (0.35%).

5.2.4 Labour inspectorates' performance assessment

In the absence of a specific quantitative technique specially designed for labour inspectorates' performance assessment, as discussed earlier, the most common methods for evaluating the performance of labour inspectorates turn out to be essentially qualitative in nature, such as the ILO labour inspection audit methodology (ILO, 2006c, 2009a, 2009b, 2011b) and the SLIC evaluation methodology (SLIC, 2007, 2015a, 2015b, 2016), or based on the analysis of quantitative and qualitative data regarding the effects of the inspection on the workplaces, collected through questionnaires filled by inspected employers and other persons involved in the inspections carried out (Geminiani & Smallwood, 2013; Niskanen et al., 2014).

The ILO audit methodology is an evaluation process aimed at assessing the existing labour inspection system, in order to allow the setting up, with the government concern, of action plans for promoting and modernizing it within the framework of the ILO con-

ventions on labour inspection. In essence, it is an audit process which includes interviews with the main concerned governmental institutions and the social partners, in addition to visiting labour inspectorates and reviewing the main labour regulations. It also involves the analysis of the labour inspection structure and functions, including the available human resources, highlighting the strengths and weaknesses and providing recommendations for promoting and enhancing the effectiveness of the labour inspection system, through joint efforts of all concerned institutions, including the social partners (ILO, 2009a, 2009b, 2011b)

The SLIC evaluation methodology, on the other hand, is aimed at assessing the capability of the labour inspectorate of the host country to implement and enforce EU Directives on OSH (SLIC, 2015b). It also seeks to ensure the effective, consistent, equivalent inspection and monitoring of the implementation of the OSH legislation in Member States, by reference to its Common Principles (SLIC, 2015a). This evaluation comprises a global assessment of the adequacy of the systems in place for inspection. It involves an assessment of the organizational structure, the administrative and operational procedures, the standards for inspection and their application, the resources available, the personnel and their training and the systems for reporting, record keeping and information collection. In addition to an in depth analysis of several documentation (e.g. latest annual report, strategic plan, summary of the main legislation, details of imminent reorganisations, personnel statistics, statistical information on inspection and investigation activities, numbers of enterprises, orders issued, penalties awarded, etc.) and the information given in the answers to the ‘Common Principles’ Questionnaire, this evaluation also involves the review of the main local OSH regulations. Moreover, it comprises one or two preparatory meetings in Luxembourg and a visit by the evaluation team (usually composed by 6 to 7 senior experienced labour inspectors of 5 to 6 other EU countries) to the host country for a week. During this week, the evaluation team meets with directors, senior managers and heads of functions of the labour inspectorate of the host country, as well as with ministry contacts, employers’ confederation, trades unions confederation and other bodies involved in the statutory inspection or enforcement of health and safety standards in the workplace. It also involves, in particular, carrying out joint visits with individual inspectors of the host country, in order to assess their inspection practices in the workplaces (SLIC, 2007, 2015a, 2015b, 2016).

More recently, several other evaluation methodologies have been applied to the labour inspectorates’ performance assessment, such as the Dashboard and the Balanced

Scorecard, as reported by Tössine and Wedege (2013). The former, by means of an executive information system that captures the performance through the measurement of a pre-selected sample of few (yet most significant) financial and non-financial key performance indicators (Bouquin, 2008; Gervais, 2000). The latter, through a performance measurement system which enables a global, integrated and multi-dimensional assessment of the labour inspectorates' performance, under four different and interdependent perspectives (financial perspective, customer perspective, internal processes perspective and learning and development perspective), through the measurement of a set of interrelated and adequately balanced lagging and leading indicators, financial and non financial indicators and short term and medium and long term indicators (Kaplan & Norton, 1992)

Within the literature specifically focused on labour inspectorates' performance assessment, however, it is important to highlight the IALI's Handbook for Labour Inspectorates, intended to fill the aforesaid literature gap, by providing labour inspectorates with practical guidance on how to measure their performance and, in particular, proposing a conceptual framework for measuring labour inspectorates' performance (Tössine & Wedege, 2013), illustrated in Figure 6.

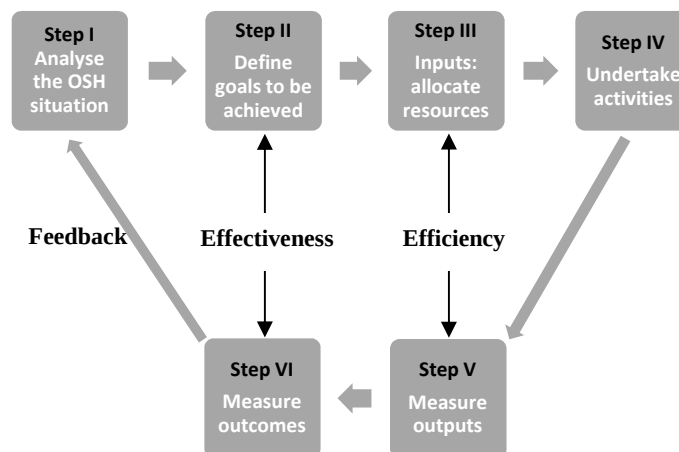


Figure 6 - IALI's conceptual framework for measuring labour inspectorates' performance
Source: Adapted from Tössine and Wedege (2013:25)

According to this conceptual framework, the process starts with the analysis of the OSH situation, followed by the goals setting phase and the resources allocation phase. Once the outputs of the activities carried out by the labour inspectorates are known, the assessment of their efficiency involves the measurement of their outputs against the

resources consumed (or the costs beared) to produce them, in order to quantify the amount of resources consumed per unit of output. As for the assessment of the labour inspectorates' effectiveness, the proposed conceptual framework suggests the measurement of their outcome levels (resulting from the outputs produced) against their defined goals, in order to assess the extent to which they are achieved. It is expected that the measurement of the labour inspectorates' outcomes can demonstrate if, at the end of the day, they are bringing added value to their stakeholders (Tösine & Wedege, 2013).

Within this conceptual framework, input indicators refer to the resources used (or consumed) in the development of the labour inspectorates' activities. They include either their quantity (e.g. staff number, number of labour inspectors, number of administrative personnel, cars, premises square meters, computers, mobile phones, etc.) or their direct or indirect costs (e.g. salaries and benefits, car or premises rents, repairs, fuel, etc.). The outputs, in turn, express the amount of activity undertaken by the labour inspectorates and might include (e.g., number of inspection visits conducted, percentage of complaints investigated, number of work-related accidents inquiries carried out, percentage of registered occupational diseases investigated, number of fines awarded, number of infringement proceedings undertaken, total amount of fines collected, number of prohibition notices issued, number of suspension notices issued, number of improvement notices issued, number of prevention initiatives delivered, number of focused campaigns, number of publications, number of partnerships developed, etc.). The outcomes indicators, on the other hand, are viewed as the social benefit of the outputs or the direct or indirect added value of such outputs to the labour inspectorate stakeholders (e.g. workers, employers and population in general). These outcomes typically include the following: decrease of the absenteeism rate; reduction of the number (or the rate) of days of absence (lost time) from work, due to work-related accidents; decrease of the number or incidence rates of fatal or non-fatal work-related accidents; and reduction of the number of notified occupational diseases (Tösine & Wedege, 2013).

Besides the input, output and outcome indicators suggested by the IALI's conceptual framework, the literature on OSH performance offers some additional OSH performance indicators. Robson et al. (2007), for example, used 3 types of performance indicators: intermediate OSH outcomes (e.g. safety climate, hazard reporting by employees, OSH awareness, workers' participation on OSH); final OSH outcomes (e.g. injury rates, lost-time injury rates); and economic OSH outcomes (e.g. firm insurance premiums, workers' compensation costs, short and long term disability costs, workplace productiv-

ity). More recently, the discussion around OSH performance indicators seems to be moving towards the distinction and adequate balance between two different types of indicators: leading and lagging indicators. The former (also known as outcome inductors) are aimed at measuring OSH performance in terms of the actions, efforts and processes more likely to induce a negative impact on lagging indicators and, thus, a positive impact on OSH performance effectiveness (Blair & O'Toole, 2010; Shea et al., 2016; Sheehan et al., 2016). They include, inter alia (Mearns et al., 2003; Robson et al., 2007; Shea et al., 2016; Sheehan et al., 2016): OSH systems (policies, procedures, practice); OSH leadership; OSH training, information, tools and resources; employee empowerment and involvement in OSH; OSH accountability; workplace OSH audits and inspections; OSH consultation and communication; prioritization of OSH; risk management; safety climate and safety management. The latter, on the other hand, which are seen as result indicators, typically comprise indicators such as (Portuguese Government, 2010; Robson et al., 2007; Roxo, 2011; Shea et al., 2016; Sheehan et al., 2016; Tösiene & Wedege, 2013): lost time injury frequency rate, medical treatment injury frequency rate, number of claims for compensation, number of near misses and number of medical-treated injuries, excluding first aid. It is important to note, though, that the OSH performance assessment based exclusively on lagging indicators is seen by several researchers and practitioners as a 'failure-focused' and reactive measurement approach, dealing with events or outcomes that have already happened, instead of focusing on the actions to be taken in order to improve those outcomes and the OSH performance (Shea et al., 2016; Sheehan et al., 2016; Sinelnikov et al., 2015). In this respect, Piore & Schrank (2008) found that the exclusively use of lagging indicators to assess the labour inspectorates' performance is likely mislead their resources' allocation. Their results suggest that certain type of productivity indicators (e.g. number of inspection visits carried out and number of sanctions issued) tend to create perverse and counterproductive incentives, inducing the increase of the number of inspections at the expense of their quality, fostering an overzealous or punitive approach, mainly based on formal action and on the imposition of sanctions, which De Baets (2003) described as a deterrent enforcement style, that may do more harm than good.

Furthermore, and within the literature specifically focused on labour inspectorates' performance assessment, it is important to highlight the research of Adalberto & Telma (2005), on the Brazilian labour inspectorate effectiveness. This research was based on the evaluation of the data of the Brazilian labour inspectorate, regarding several inputs

(number of labour inspectors and costs), outputs (e.g. number of inspection visits, number of workers and employers covered by the inspection visits, employer's size, number of infraction notices issued, number of offenders notified and amount of fines collected) and outcomes (e.g., compliance rate, number of infringements regularized by the offenders and regularization rate). Their results show that the Brazilian labour inspectorate had no effectiveness, in spite of reaching a very large number of workers (as a proportion of the workforce), collecting a large amount of fines and being efficient (in terms of the resources consumed per unit of output). They found, in particular, that it was ineffective because the inspection visits were mainly targeted to large companies (with higher interest to meet internal quantitative goals) which were precisely the ones who showed the lowest rates of non-compliance (being the least in need for supervision) and regularization rates (since they had the means to take advantage of the judicial system inefficiency in order to circumvent compliance with regulations).

Other research study worth mentioning, in this context, is the one carried out by Geminiani & Smallwood (2013), concerning the performance assessment of the Occupational Health and Safety Inspectorate of South Africa (DoL). Based on the analysis of 107 questionnaires about the perceptions of building and civil contractors, OHS consultants, project managers, designers and DoL's inspectors, regarding DoL's performance, this research study used the following OSH performance indicators: effectiveness in conducting their duties; construction knowledge and skills; visit's checklists suitability; liaison and promotion effectiveness; culture (morale, motivation and satisfaction); advice and counseling performance; enforcement effectiveness; contribution to OSH improvements in employer's workplaces; OHS promotion effectiveness; and impact on work-related accidents prevention.

It is also worth mentioning the research carried out by Niskanen et al. (2014) on the performance of the Finnish OSH Inspectorate, through the evaluation of its effects on the inspected workplaces of the chemical industry. The data, collected through an online electronic questionnaire, completed by 85 OSH managers and by 120 workers' OSH representatives, was analyzed through the regression analysis of the selected output or effect indicators (assessed deficiencies; OSH documents prepared; deficiencies corrected; new information on the legal obligations; and OSH development) on the chosen input indicators (minimum level of law; advice in order to exceed the minimum level; binding obligations to remedy deficiencies; strengthening the enforcement; follow-up of OSH management systems' implementation; and the quality of inspections).

5.3 Methodology

5.3.1 *Population, sample and data*

Considering that the research on this particular topic is aimed at assessing the ACT efficiency and effectiveness in preventing work-related accidents and that its services are primarily provided, as foreseen in its organic law, through its 32 local branches, distributed across the continental Portuguese territory, the population to be studied (which coincides with the respective sample) is made up of all these 32 ACT local branches. Moreover, and considering the data availability, this research is focused on the performance assessment of these 32 local branches in the year 2013.

As for the data used in the present research study, it includes the ACT 2013 internal data on the resources consumed (inputs), costs supported, services provided (outputs) and respective outcomes, in relation to each of its 32 local branches (see Appendices 8 to 10). It also comprises a set of additional contextual data on the ACT local branches activities, resources, costs, outputs, outcomes and environment (see Appendices 11.1 to 11.9). This research is also based on the 2013 official data, provided by the GEP of the MTSSS (GEP, 2015), regarding the number of fatal and non-fatal work-related accidents occurred in Portugal and the number of days of absence from work resulting from the latter, per ACT local branch area of jurisdiction (see Appendices 11.2 to 11.7). It was also used, as a benchmark for the outcome targets of the ACT local branches, the 2013 official data available on the Eurostat (2016) ESAW online database, regarding the incidence rates of fatal and non-fatal work-related accidents per 100,000 workers and economic activity sector, as well as in relation to the EU 28 average days of absence from work due to non-fatal work-related accidents per economic activity sector. It is worth mentioning, in this regard, that it was necessary to homogenize the Portuguese data, in order to ensure their compatibility and comparability with the one available in the ESAW. Indeed, the various statistics on accidents at work do not all follow the same criteria (GEP, 2015:12-13): ILO statistics, for example, consider the fatal work-related accidents and the non-fatal work-related accidents that generate at least 1 day of absence; Eurostat, in turn, considers the fatal work-related accidents and the non-fatal work-related accidents that generate at least 4 days of absence; and the Portuguese statistics consider all work-related accidents (fatal and non-fatal) with and without lost working days. As such, and to ensure the data comparability, the number of non-fatal

work-related accidents, as well as the number of the absence days from work mentioned in this study, both refer to non-fatal work-related accidents that generated at least 4 days of absence from work. Furthermore, and taking into account that the ACT only has legal jurisdiction over the continental territory of Portugal, thus excluding the Azores and Madeira islands, as mentioned earlier, the work-related accidents data used in the present research study does not include the work-related accidents which occurred in Azores, Madeira and abroad. Moreover, this research also used the official data on the employed population by municipality and economic activity sector, collected by the Portuguese Statistics National Institute (INE) in the context of the 2011 population census, which was retrieved from the Statistics of Portugal Portal (INE, 2013), in order to estimate the employed population by economic activity sector and jurisdiction area of each ACT local branch (see Appendix 11.1). In addition, it was also used the official data on the Portuguese municipalities areas, available in the Portugal Statistics Online Database (PORDATA, 2013), with a view to calculate the size of each ACT local branch area of jurisdiction.

After the collection of the necessary data regarding the selected input, output and outcome indicators for the three specified DEA models, the DEA problems were solved through the use of the *EMS* software, version 1.3.0. The resulting *EMS* outputs are exhibited in Appendices 12.1 to 12.6.

5.3.2 Data analysis methods

The ACT transforms the public expense invested in its resources in the provision of services (measurable outputs) with the objective of achieving positive outcomes valuable to the society in general, through 32 fairly similar local branches, in terms of general goals and technology, activities performed and nature of consumed resources and produced outputs. Considering the advantages of aggregating the information regarding multiple inputs and multiple outputs into a single performance measure, the DEA was applied to assess the performance of the ACT, through the comparison of its 32 branches relative efficiency and effectiveness. Indeed, DEA is a non-parametric productive efficiency measurement method, initially developed by Charnes et al. (1978), particularly suitable for the performance assessment of a collection of fairly homogeneous Decision Making Units (DMUs) which transform a set of inputs in outputs, providing certain outcomes to the respective stakeholders. It is especially designed for assessing the relative

performance of such DMUs and identifying the benchmarks for improvement, on the basis of its multiple input, output and outcome indicators, either in terms of efficiency or effectiveness (Amado, 2003; Schinnar, Kamis-Gould, Delucia, & Rothbard, 1990; Szczepura, Davies, Fletcher, & Boussofiane, 1993). The measure of efficiency for each DMU (TE_j) is calculated by means of the ratio between the weighted sum of its s outputs and the weighted sum of its m inputs, according to the following expression, adapted by Martins (2012:55) from Charnes et al. (1978:430):

$$TE_j = \frac{\sum_{r=1}^s U_{rj} Y_{rj}}{\sum_{i=1}^m V_{ij} X_{ij}}, \quad j = 1, \dots, n \quad (7)$$

with $U_{rj}, V_{ij}, Y_{rj}, X_{ij} \geq 0, \forall j, r$ and i and where DMU_j is the DMU being evaluate in the set of $j = 1, \dots, n$ DMUs, the Y_{rj} and X_{ij} are the observed levels of the r th output and i th input at DMU_j and the U_{rj} and V_{ij} are the unit weight of the r th output and the unit weight of the i th input of DMU_j .

Thus, the efficiency score of any DMU is obtained as the maximum of the ratio of weighted outputs to weighted inputs, subject to the condition that the similar ratios for all DMUs in the sample are less than or equal to 1, by calculating the unit weight of the each output and each input (U_{rj} and V_{ij}) for all DMUs which maximize the following linear programming function (Charnes et al., 1978:430).

$$\max h_0 = \frac{\sum_{r=1}^s U_r Y_{r0}}{\sum_{i=1}^m V_i X_{i0}} \quad (8)$$

subjected to:

$$\frac{\sum_{r=1}^s U_r Y_{rj}}{\sum_{i=1}^m V_i X_{ij}} \leq 1; \quad j = 1, \dots, n,$$

$$U_r, V_i \geq 0; \quad r = 1, \dots, s; \quad i = 1, \dots, m$$

In this formulation, the DMU_0 is the DMU of this reference set of $j = 1, \dots, n$ DMUs being rated relative to the others, to which the above maximization problem will assigne the most favorable weighting that the constraints allow (Charnes et al., 1978:430).

Since 1978, this technique has benefitted from several methodological enhancements. One of such developments was the expansion of the original CCR (Charnes, Cooper and Rhodes) model, which assumes Constant Returns to Scale (CRS), into a Variable Returns to Scale (VRS) model, the BCC (Banker, Charnes and Cooper) model, in order to consider the existence of VRS and isolate and measure its effects, as proposed by Banker et al. (1984), through the addition of a convexity constraint and requiring that the DMU λ_j scale multipliers add up to 1 (Banker et al., 1984; Camanho & Dyson, 1999). The scale efficiency (SE) of a DMU can therefore be obtained as the ratio of its technical efficiency (TE), calculated through the CCR model (assuming CRS), to its pure technical efficiency (PTE), calculated through the BCC model (assuming VRS) (Camanho & Dyson, 1999; Martins, 2012). For a recent review of the literature on DEA methodological enhancements, please refer to Liu, Lu, & Lu (2016) and Liu, Lu, Lu, & Lin (2013).

When compared with other widely used analytical techniques (e.g. multiple indicators, ratio analysis and parametric frontier estimation approaches) DEA presents several advantages in measuring the performance of the ACT. It allows assessing the ACT performance considering simultaneously the multiple inputs used to produce its outputs, without knowing the efficient input/output relationships or requiring information about the weights or prices in advance. Furthermore, it provides a single aggregate measure of relative performance, facilitating the comparison between the different branches. Finally, it also enables the consideration of exogenous variables, allowing adjustments for non-controllable factors (Banker & Morey, 1986; S. P. Santos & Amado, 2014; Sherman & Zhu, 2006), such as the different sizes of the ACT local branches areas of jurisdiction. Moreover, the information that can be obtained from the DEA results can be very useful in practice, considering that it identifies the ACT branches that have potential to improve their performance, identifying their relative strengths and weaknesses, estimating targets for performance improvement and identifying relevant benchmarks to be followed. In spite of not defining, in precise terms, the most appropriate corrective measures to be adopted in order to improve performance (Sherman & Zhu, 2006:112-113), the DEA technique, nonetheless, allows ACT managers to focus their attention on the investigation and comparison of the ACT local branches that have potential to improve with their respective benchmarks, providing several paths likely to improve the ACT efficiency and effectiveness levels.

Although no application of DEA to the performance assessment of labour inspectorates could be identified in the literature, this performance analytical tool is very versatile and has been applied over the years to a wide range of industrial and non-industrial economic activity sectors, such as health care, banking, education, judicial system, manufacturing, retailing, agriculture, transportation, electricity distribution industry, etc. For examples of DEA applications please refer to Amado (2003), Amado & Santos (2009), Amado, Santos, & Sequeira (2013) Camanho & Dyson (1999), Martins (2012), Santos & Amado (2014) and Szczepura et al. (1993). For a recent review of the literature regarding DEA applications, please refer to Liu et al. (2016, 2013).

Moreover, and in order to allow a deeper understanding of the ACT local branches efficiency and effectiveness drivers, it was also conducted a exploratory analysis on the potential predictors of the ACT local branches relative efficiency and effectiveness. Besides the comparison of the efficient and the effective local branches with the inefficient and the ineffective ones, regarding the average level of their input, output, and outcome variables (cf. Appendices 8 to 9), as well as their average level concerning other additional contextual variables (see Appendices 11.1 to 11.9), it was also carried out a correlation analysis (see Appendix 13) between the local branches relative efficiency and effectiveness scores (see Table 16) and the aforementioned ACT local branches variables. The latter included not only the ones considered in the DEA efficiency and effectiveness models (exhibited in Appendices 8 to 10), but also a set of additional contextual variables, concerning the ACT local branches activities, resources, costs, outputs, outcomes and internal and external environment variables (see Appendices 11.1 to 11.9), which are expected to provide a better insight on its relative efficiency and effectiveness. In addition, the exploratory analysis carried out also involved the regression of the efficiency and effectiveness scores on those variables, using the ordinary least squares (OLS), in order to assess their individual significance level (see Appendix 13). Several research studies support the use of such two-stage approach, comprising a DEA model followed by a regression model - such as the OLS (Banker & Natarajan, 2008; Hoff, 2007; McDonald, 2009), maximum likelihood (Banker & Natarajan, 2008), Tobit (Banker & Natarajan, 2008; Hoff, 2007), truncated (Simar & Wilson, 2007) or fractional (Martins, 2012; E. A. Ramalho, Ramalho, & Henriques, 2010; E. A. Ramalho, Ramalho, & Murteira, 2011; J. J. S. Ramalho & Silva, 2009) -, arguing that it yields consistent estimators for the impact of contextual variables on efficiency. Nevertheless, Simar and Wilson (2011) concluded, more recently, that the sec-

ond-stage OLS estimation is only consistent under very atypical and rare circumstances, thus limiting its application, suggesting that bootstrap methods provide the only feasible means for inference in the second stage. As such, the results obtained, in spite of giving important clues about the potential predictors of the ACT local branches relative cost efficiency, should be interpreted with caution.

5.3.3 Proposed conceptual framework for the ACT performance assessment

The conceptual framework proposed in this research for the performance assessment of the Portuguese labour inspectorate follows closely the ACT management cycle and consists of an adaptation of the IALI's conceptual framework for measuring labour inspectorates' performance discussed earlier. The suggested conceptual framework for the ACT's performance assessment is illustrated in Figure 7.

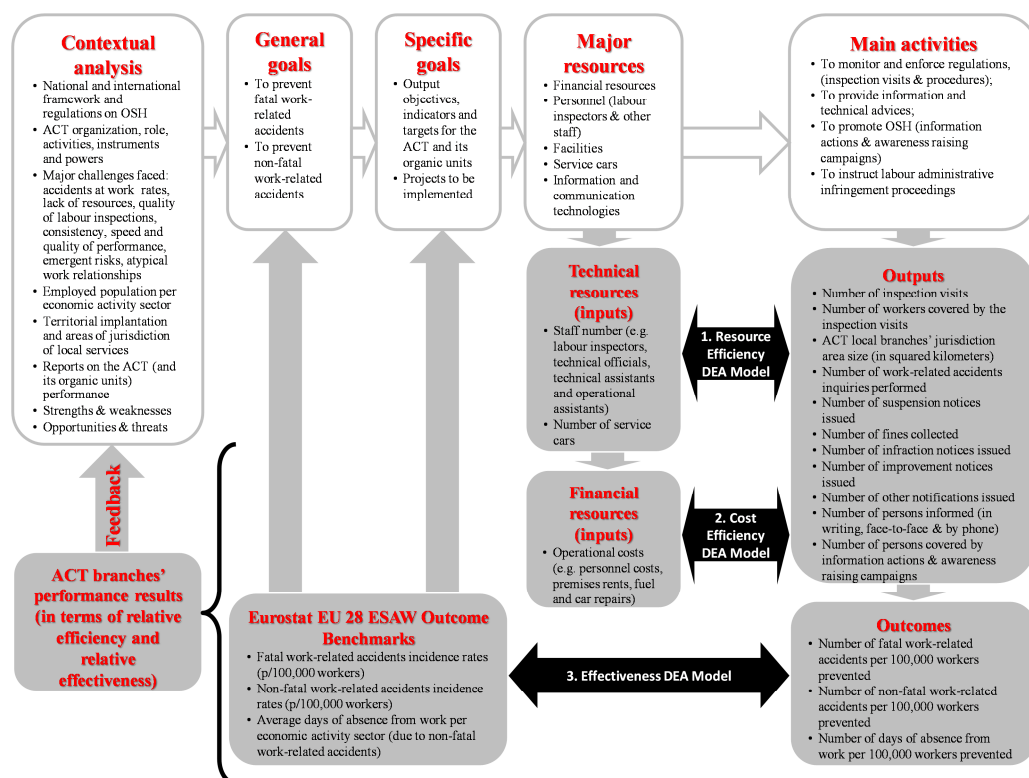


Figure 7 - Proposed conceptual framework for the performance assessment of the ACT

Source: Own elaboration, adapted from Tösine and Wedege (2013:25)

As shown by the top white boxes of Figure 7, it reflects the ACT management cycle and the associated planning, organizing, leading, executing, monitoring and feedback processes. Since its contextual analysis (internal and external environment analysis), passing by the definition of general and specific goals, consubstantiated in the ACT's

Annual Activities Plan (ACT, 2015a, 2016a) and in its QUAR (ACT, 2015b, 2016b), followed by the allocation of the inputs/resources (subjected to the approval of the ACT annual budget and map of personnel) and the execution of the planned activities, until the performance assessment and monitoring and respective results feedback into the management cycle. In addition, this conceptual framework is also focused on the activities performed by the ACT local branches that are more relevant and resources demanding, which were already mentioned. The accomplishment of such activities, on the other hand, besides the consumption of resources is also expected to provide, in turn, measurable outputs and valuable outcomes for the society, which should be duly evaluated. As such, the conceptual framework proposes the insertion in the ACT management cycle, of the elements and processes shaded in gray and in black in Figure 7, concerning the proposed methodology for the performance assessment of the ACT, as well as its results feedback process into the management cycle. Indeed, and once the ACT resources have been consumed in the performance of its planned activities and its main outputs and outcomes have been provided, the conceptual framework proposes the ACT performance assessment, through the measurement of the relative efficiency and relative effectiveness of the ACT 32 local branches in its provision.

The ACT efficiency is assessed, as shown in the right hand side of Figure 7, by comparing its output actual levels (rather than the extent to which they meet any output goal) regarding the most relevant output indicators with the consumed inputs. The output indicators proposed by the conceptual framework are the most commonly used by the labour inspectorates to guide and evaluate its performance and, in particular, the ones already used by the ACT (e.g., number of inspection visits, number of infraction notices issued, number of workers covered by inspection visits, etc.). For efficiency assessment purposes, the proposed conceptual framework foresees the use of a Resource Efficiency DEA Model (Model 1), which compares the outputs produced with the consumed resources, and a Cost Efficiency DEA Model (Model 2), which compares the same output levels with the costs supported by each local branch in its provision. As a result, each efficiency DEA model provides a measure of relative efficiency for each branch by comparing the ratio of the weighted sum of outputs to the weighted sum of inputs of each branch with the maximum ratio observed within the ACT. The resources (input indicators) considered in this conceptual framework to assess the ACT efficiency are the ones that reflect the most relevant and expensive resources needed and consumed by the ACT local branches in the performance of its activities and in the provi-

sion of its outputs (e.g. number of different types of staff and service cars). Moreover, and in order to allow the assessment of the cost efficiency of the ACT, besides its resource efficiency, this conceptual framework foresees the use a different input indicator (the main operational costs of the ACT local branches), which quantifies the level of financial resources consumed by the ACT local branches in the production of its outputs.

As for the effectiveness assessment, the proposed conceptual framework uses an Effectiveness DEA Model (Model 3), as shown in the bottom of Figure 7, in order to assess the ACT local branches relative effectiveness in achieving or surpassing the Eurostat (2016) ESAW benchmarks on fatal and non-fatal work-related accidents incidence rates and average days of absence from work (here understood as the ACT outcome targets). Based on the ‘benefit of the doubt’ approach proposed by Cherchye, Moesen, Rogge, & Puyenbroeck (2007), this DEA model is designed to measure the extent to which each the ACT local branch prevents the occurrence of fatal and non-fatal work-related accidents per 100,000 workers and prevents the absence from work (due to non-fatal work-related accidents) per 100,000 workers, in relation to the ESAW benchmarks, irrespectively of its scale of operations, level of resources consumed or level of operational costs supported.

Furthermore, this conceptual framework provides that the results of the ACT performance assessment are incorporated into the management cycle, as shown in the bottom-left side of Figure 7, allowing its weaknesses and strengths, in terms of efficiency and effectiveness, to be feedback into the ACT contextual analysis. The rationale being the convenience of considering those weaknesses and strengths in the subsequent planning phase, enabling the correction of the inefficiency and ineffective sources, through a better organization, management, scaling, and focus of the available resources, in order to improve the future efficiency and effectiveness of the ACT in preventing work-related accidents.

It is foreseen that this conceptual framework, moreover, may introduce into ACT’s current management cycle, in a perfectly integrated way, as shown by the boxes shaded in gray and by the elements shaded in black of Figure 7, a new methodology for assessing its performance, which allows ACT to overcome the shortcomings of its current performance evaluation method. The latter refers to the absence of any efficiency assessment. In fact, ACT does not currently assess its overall efficiency or their local branches relative efficiency, by comparing its outputs or their local branches outputs to

its costs or to the resources consumed in their production. These shortcomings also comprise its inadequate effectiveness assessment methodology, which results, in particular, from the following: it is mainly based on the extent to which the ACT local branches (as well as the overall ACT) achieves the targets for the several internal output goals established; it only incorporates one outcome (the percentual reduction of the number of fatal work-related accidents) which, moreover, is not defined at the local branches level, do not take into account the different distribution, across the local branches areas of jurisdiction, of the volume of employed population per different risk economic activity sector and is not established with reference to any international benchmark; the lack of outcome indicators likely to allow measuring its effectiveness in preventing non-fatal work-related accidents and days of absence from work (at both ACT and local branches levels).

Furthermore, it is also expected that by using multiple input, output and outcome indicators, the proposed performance assessment methodology can improve the quality, relevance and completeness of the results of its performance assessment, whilst improving its comparability, by synthesizing their local branches relative efficiency and relative effectiveness into a single aggregate measure of relative performance.

5.3.4 DEA models specification

Considering that the main purpose of the research on this topic is the assessment of the ACT efficiency and effectiveness in preventing work-related accidents, three DEA models were applied: a Resource Efficiency DEA Model (Model 1), aimed at assessing the ACT efficiency, through the comparison of the ACT local branches main outputs with the major technical resources consumed in its provision; a Cost Efficiency DEA Model (Model 2), intended to assess the ACT efficiency, through the comparison of the ACT local branches main outputs with the major costs supported to produce them; and a Effectiveness DEA Model (Model 3), designed to measure the ACT effectiveness, through the assessment of the extent to which the ACT local branches achieve their outcomes, in relation to the ESAW benchmarks, irrespectively of the ACT local branches scale of operations, level of resources consumed or operational costs beared to ensure it.

These DEA models are all output oriented. This option is explained by the assumption that it is more important to improve the outputs and the outcomes (so as to improve OSH conditions and, in this way, to prevent the occurrence of work-related accidents

and the loss of human lives and of working days), than to minimize the inputs. It is also supported by the greater elasticity associated to the outputs increase than to the inputs reduction (given the particular legal conditions concerning the dismissal or mobility of civil servants and the termination or amendment of procurement contracts) which makes it clearly easier and more controllable by the ACT local branches directors to increase the outputs than to reduce the inputs.

In addition, the DEA models were successively applied under the assumptions of the existence of both CRS and VRS, except for the effectiveness DEA model, to which the returns to scale (RTS) are irrelevant. This option stems from the importance attributed to the measurement of the TE and the PTE of each ACT local branch, based on its CRS and VRS scores, as well as of its SE, as the ratio between its CRS and VRS scores, in order to measure the scale factor effect in the ACT performance.

5.4.4.1 Input, output and outcome indicators

The selection of the input, output and outcome indicators to be included in the three DEA models considered, besides the data availability, the ACT production process and the nature of the major resources consumed by its local branches in their most relevant activities of transforming inputs into outputs. It also considered the presumed most relevant and most time, costs and resources demanding outputs, as well as their most valuable outcomes to the stakeholders, as referred to in the reviewed literature. The need to avoid redundant variables as well as highly correlated input or output indicators, which might capture the same reality while jeopardizing the discriminative ability of the models, was also taken into account.

These selected input, output and outcome indicators are all supported by the literature and reflect with precision the ACT production process, being therefore expected to capture and to measure the level of consumption of its main resources (inputs), of the more important results generated by its most relevant activities (outputs), and of the most valuable social benefits arising from the latter (outcomes), namely in terms of the presumed prevented accidents at work and days of absence from work resulting from or attributable to the labour inspectorate performance.

The input, output and outcome indicators used in the three DEA models are presented in Table 13, whereas their respective values are exhibited in the Appendices 8 to 10.

Indicators	DEA Model 1 - Resource Efficiency	DEA Model 2 - Cost Efficiency	DEA Model 2 - Effectiveness
Inputs	I1: Number of labour inspectors (LI) I2: Number of technical officials (TO) I3: Number of technical assistants (TA) I4: Number of operational assistants (OA) I5: Number of service cars (SRVCAR)	I6: Main operational costs (COSTS)	I7: Variable with a unit value (UNINPUT)
Outputs	O1: Number of work-related accidents inquiries performed (WRAINQ) O2: Number of suspension notices issued (SUSPNOT) O3: Number of fines collected (FINCOL) O4: Number of infraction notices issued (INFRNOT) O5: Number of improvement notices issued (IMPRNOT) O6: Number of other notifications issued (OTHNOT) O7: Size of the ACT local branch jurisdiction area, in square kilometers (AREA) O8: Number of inspection visits carried out (INSPVIS) O9: Number of workers covered by the inspection visits (WRKCOVINSP) O10: Number of persons informed through the local written information service (WRINFSRV) O11: Number of persons informed through the local face-to-face information service (PRINFSRV) O12: Number of persons informed through the local phone information service (PHINFSRV) O13: Number of persons covered by the information actions and awareness-raising campaigns (COVINFAW)	O1: Number of work-related accidents inquiries performed (WRAINQ) O2: Number of suspension notices issued (SUSPNOT) O3: Number of fines collected (FINCOL) O4: Number of infraction notices issued (INFRNOT) O5: Number of improvement notices issued (IMPRNOT) O6: Number of other notifications issued (OTHNOT) O7: Size of the ACT local branch jurisdiction area, in square kilometers (AREA) O8: Number of inspection visits carried out (INSPVIS) O9: Number of workers covered by the inspection visits (WRKCOVINSP) O10: Number of persons informed through the local written information service (WRINFSRV) O11: Number of persons informed through the local face-to-face information service (PRINFSRV) O12: Number of persons informed through the local phone information service (PHINFSRV) O13: Number of persons covered by the information actions and awareness-raising campaigns (COVINFAW)	O14: Number of prevented fatal work-related accidents per 100,000 workers (PFWRA) O15: Number of prevented non-fatal work-related accidents per 100,000 workers (PNFWRA) O16: Number of prevented days of absence from work per 100,000 workers (PDAYSABS)
Outcomes			

Table 13 – Input, output and outcome indicators considered in the three DEA models

Source: Own elaboration

The input variables included in the resource efficiency DEA model comprise the different staff assigned to the ACT local branches (the number of labour inspectors, including the ACT local branches directors; technical officials; technical assistants; and operational assistants) and the number of service cars. The information and telecommunication technologies, along with the administrative hardware and equipment, although important, were not considered, because they are common to every ACT local branch, not justifying performance differences between local branches, to the extent that they all have them in so far as is strictly necessary, having regard to the number of employees for whom they are intended. The same applies to the area dedicated to the ACT local branches facilities, as they all meet the minimum requirements for its purpose. As for the cost efficiency DEA model, the model includes only one input indicator: the main operational costs of the ACT local branches (representing around 91% of their total operational costs). This input indicator includes, namely: personnel costs (wages, civil

servants pension system, inspection action supplement received by labour inspectors, vacation allowance, Christmas bonus, social security, meal allowance, per diems and overtime), premises rents, fuel and car repairs. Moreover, and regarding the effectiveness DEA model, bearing in mind that the purpose of the DEA effectiveness model is to assess the extent to which the ACT local branches achieve their outcomes, irrespectively of their branches scale, as well as of the costs supported and the resources consumed, the input indicator is set to one for all branches, in consistency with the ‘benefit of the doubt’ approach, proposed by Cherchye et al. (2007).

Regarding the output variables to be considered on both the resource efficiency and cost efficiency DEA models, they are intended to reflect the result of the core activities performed by the ACT local branches in preventing the occurrence of work-related accidents. As such, they include output indicators for the most important and more demanding activities of the ACT local branches, in terms of resources, costs and time consumed, in particular: number of inspection visits carried out; number of workers covered by the inspection visits; number of work-related accidents inquiries conducted; number of suspension notices issued; number of infraction notices issued; number of improvement notices issued; number of other notifications issued (e.g., recommendation notices, warnings, warning notices and notices to establish debts to workers and/or to social security); the number of fines collected; number of persons informed through the local written information service; number of persons informed through the local face-to-face information service; number of persons informed through the local phone information service; and number of persons covered by the information actions and awareness-raising campaigns. In order to account for impact of population density, the efficiency models also include a non-controllable output: the size of the ACT local branch jurisdiction area in square kilometres. The inclusion of this non-controllable output follows the methodology proposed by Banker & Morey (1986), which includes this exogenously fixed indicator, without requiring its augmentation. The efficiency models determine the extent to which the controllable outputs can be increased whilst maintaining the area of jurisdiction covered by each branch. In fact, and in spite of the ACT local branch jurisdiction area being established by law (not being therefore changeable by the local service director or by the ACT Inspector General), its inclusion is intended to avoid the disproportionately penalization of the local branches with larger jurisdiction areas and/or lower density of population employed. Indeed, it is expected that its non-inclusion would render inefficient the local branches with greater jurisdiction areas

and/or lower density of population employed. The reason for this expectation is that, if on the one hand, the greater the size of a area of jurisdiction the smaller is expected to be the number of inspection visits carried out and, consequently, the lower is expected to be the number of applied inspection procedures, on the other hand, the greater is likely to be also the time, costs and resources spent to make the same number of inspection visits or to apply the same number of inspection procedures.

Moreover, and considering that the causality patterns between fatal, non-fatal and less serious work-related accidents are different, thus implying different prevention strategies to ensure their effectiveness, as argued by Hale (2001) and noted by Jacinto et al. (2007), this model include three different outcomes, in order to capture the effectiveness of the ACT in the prevention of work-related accidents with different levels of severity: the fatal and the non-fatal (and, for the latter, it breakdown in terms of severity, based on the number of absence days from work due to non-fatal accidents at work). In addition, and rather than measuring the extent to which the ACT meets its internal goals (in terms of the percentage reduction of the number and incidence rate of accidents at work), this model measures its ability to meet or surpass the EU 28 benchmarks with which it is usually compared. Taking into account, however, the fact that the DEA models are aimed at minimizing the inputs and/or maximizing the outputs (Scheel, 2001) and the need to avoid undesirable outcomes, the following outcome indicators were included in the effectiveness DEA model: ‘number of prevented fatal work-related accidents per 100,000 workers’; ‘number of prevented non-fatal work-related accidents per 100,000 workers’; and ‘number of prevented days of absence from work per 100,000 workers’. These outcome indicators may be viewed either as the extent to which the ACT meets its goals (as set up by the Eurostat (2016) ESAW benchmarks for fatal and non-fatal work-related accidents incidence rates and for the number of days of absence) or as the magnitude of the ACT ‘savings’ (in relation to the mentioned ESAW benchmarks) in terms of the number of prevented fatal and non-fatal work-related accidents per 100,000 workers and in terms of the number of prevented days of absence from work (due to non-fatal accidents at work) per 100,000 workers. The outcome indicators ‘number of prevented fatal work-related accidents per 100,000 workers’ (and ‘number of prevented non-fatal work-related accidents per 100,000 workers’) were computed, for each ACT local branch, as the sum of the differences between the ESAW benchmarks for fatal work-related accidents incidence rate per 100,000 workers and economic activity sector (and the ESAW benchmarks for non-fatal work-related accidents incidence

rate per 100,000 workers and economic activity sector) and each ACT local branch jurisdiction area fatal work-related accidents incidence rate per 100,000 workers and economic activity sector (and non-fatal work-related accidents incidence rate per 100,000 workers and economic activity sector). As a result of this calculation, some ACT local branches presented negative values for the sum of such differences (meaning that they presented, in 2013, incidence rates of fatal and non-fatal work-related accidents per 100,000 workers and economic activity sector which were globally higher than the ESAW benchmarks). Since one of the underlying assumptions of the classic DEA models is the non-negativity of inputs and outputs (Allahyar & Rostamy-Malkhalifeh, 2015), these variables had to suffer an additional transformation. However, these variables could not be treated as a positive input, as suggested by Scheel (2001), because not all values were negative. In this context, this drawback was overcome, as proposed by several researchers (Ali & Seiford, 1990; Allahyar & Rostamy-Malkhalifeh, 2015; Charnes, Cooper, Seiford, & Stutz, 1983), by adding a big enough scalar to these variables, so as to make all negative values positive. The outcome indicator ‘number of prevented days of absence from work per 100,000 workers’, on the other hand, was calculated according to the methodology described below. Firstly, it was calculated the EU 28 benchmarks, regarding the average days of absence from work due to non-fatal work-related accidents per economic activity sector, with the data available for 2013 in the ESAW online database. These EU 28 average days of absence per economic activity sector were calculated as the average, for each economic activity sector, of the product of the respective number of non-fatal work-related accidents per each severity interval (in days) by its interval average value. Regarding the EU 28 non-fatal work-related accidents with unknown economic activity sector (31,919 non-fatal work-related accidents, representing about 1% of the total of 3,127,548 non-fatal work-related accidents occurred in the EU 28 in 2013) or with no specified duration (937,458 non-fatal work-related accidents, corresponding to about 30% of the total), the procedure undertaken assumed its proportional distribution across the different economic activity sectors and across the various severity intervals. Secondly, for each ACT local branch jurisdiction area and economic activity sector, the average number of days of absence from work was calculated as the ratio between two quantities: (1) the number of days of absence from work for each ACT local branch jurisdiction area and economic activity sector; and (2) the number of the non-fatal work-related accidents occurred in Portugal in 2013 in that ACT local branch jurisdiction area and economic activity sector. Thirdly, for

each ACT local branch jurisdiction area and economic activity sector, the difference between the EU 28 average days of absence from work per economic activity sector and the average days of absence from work in each ACT local branch jurisdiction area per economic activity sector was calculated. The latter was then multiplied, for each ACT local branch jurisdiction area and economic activity, by the non-fatal work-related accidents incidence rate per 100,000 workers of each ACT local branch jurisdiction area and economic activity sector, in order to calculate the number of the prevented days of absence from work per 100,000 workers for each ACT local branch jurisdiction area and economic activity sector. The total number of prevented days of absence from work per 100,000 workers for a given ACT local branch jurisdiction area, then resulted from the sum, for that ACT local branch jurisdiction area, of the number of prevented days of absence from work per 100,000 workers of all economic activity sectors of that particular branch area of jurisdiction. It was also necessary to turn the negative values of this variable (regarding the ACT local branches in which jurisdiction areas there were no savings of days of absence from work per 100,000 workers) into positive ones. In consistency with the procedure discussed above, this was accomplished by adding to all values of the variable a big enough scalar.

There are two important aspects to emphasize, however, regarding the methodology used to calculate the outcome variables used in the effectiveness DEA model. The first one relates with the fact that the methodology used ensures that the different level of risk associated with different sectors of economic activity is taken into account. By calculating the savings observed in each activity sector with reference to the respective sector benchmark of the EU 28, the branches with a more unfavourable distribution of the employed population are not penalized. The second aspect is that the need to transform the outcomes by adding a scalar value limits the usefulness of the scores obtained from the effectiveness model. The reason for this is that, as discussed by Ali & Seiford (1990), when a scalar is added to the outputs of the DEA model the scores of the units that are not part of the frontier may be affected. However, also as discussed by Ali & Seiford (1990), when the model respects the convexity assumption, one can rest assured that adding a scalar will not affect the best practice frontier. Considering that Model 3 respects the convexity assumption (because it includes a single unitary input for all units), the identification of the units that are part of the best practice frontier is robust to the transformation undertaken.

Table 14, which follows, lists the input, output and outcome indicators discussed above, along with the summary of their main descriptive statistics.

Indicators	DEA Model	Average	Std Dev	Coefficient of variation	Min	Max
Inputs						
LI	1	11.06	8.76	0.79	3.00	42.00
TO	1	4.59	3.77	0.82	1.00	14.00
TA	1	5.66	3.31	0.58	1.00	16.00
OA	1	1.16	1.17	1.01	0.00	4.00
SRVCAR	1	4.03	2.13	0.53	2.00	11.00
COSTS	2	653,452.42	516,814.01	0.79	167,365.61	2,523,890.03
UNINPUT	3	1.00	0.00	0.00	1.00	1.00
Outputs						
WRAINQ	1 and 2	18.75	15.40	0.82	1.00	66.00
SUSPNOT	1 and 2	9.84	7.80	0.79	2.00	31.00
FINCOL	1 and 2	657.50	373.46	0.57	14.00	1,592.00
INFRNOT	1 and 2	334.47	259.68	0.78	50.00	1,218.00
IMPRNOT	1 and 2	410.56	305.70	0.74	47.00	1,280.00
OTHNOT	1 and 2	164.31	173.47	1.06	9.00	907.00
AREA	1 and 2	2,784.34	2,807.68	1.01	151.00	13,851.00
INSPVIS	1 and 2	1,298.25	1,232.94	0.95	136.00	5,495.00
WRKCOVINS	1 and 2	10,627.56	12,805.94	1.20	761.00	66,932.00
WRINFSRV	1 and 2	367.53	567.31	1.54	0.00	2,688.00
PRINFSRV	1 and 2	6,825.63	6,652.98	0.97	1,224.00	27,133.00
PHINFSRV	1 and 2	1,394.28	1,298.39	0.93	8.00	4,726.00
COVINFAW	1 and 2	11,634.75	10,859.45	0.93	1,905.00	47,381.00
Outcomes						
PFWRA	3	139.01	57.91	0.42	1.00	215.94
PNFWRA	3	36,855.77	14,328.47	0.39	1.00	57,030.73
PDAYABS	3	1,908,243.07	628,313.33	0.33	1.00	3,179,677.85

Table 14 – Summary statistics of the input, output and outcome indicators used in the three DEA models

Source: Own elaboration, based on the ACT local branches input, output and outcome data (see Appendices 8 to 10)

5.4.4.2 Weight restrictions

In the absence of weight restrictions, DEA allows flexibility in the choice of inputs and outputs weights. In such case, the greater the number of the input (m) and output (s) variables included in the DEA model, the lower the level of discrimination of its results. In order to help the practitioners to choose a reasonable number of inputs and outputs variables, some researchers propose a few 'rules of thumb'. Friedman & Sinuany-Stern (1998), for example, suggest that the sum of the number of the input variables with the number of the output variables ($m + s$) should be less than one-third of the number of DMUs. Dyson et al. (2001), in turn, suggest that the number of DMUs should be at least the double of the product of the number of inputs by the number of outputs ($2 \times m \times s$).

In the present research study, only the effectiveness DEA model complies with such rules. Neither the resource efficiency DEA model (Model 1), nor the cost efficiency DEA model (Model 2) is in accordance with these 'rules of thumb'. In Model 1, the number of the ACT local branches (32 DMUs) is both less than the triple of the sum of the number of its inputs and outputs [$32 < (5 + 13) \times 3$] and than the double of the prod-

uct between its input and output numbers ($32 < 2 \times 5 \times 13$). As for the Model 2, in spite of this model being in accordance with the second mentioned ‘rule of thumb’, since the number of the ACT local branches is higher than the double of the product between its input and output numbers ($32 > (2 \times 1 \times 13)$), it does not verify the first one, as the number of the ACT local branches is less than the triple of the sum of the number of its inputs and outputs [$32 < (1 + 13) \times 3$].

As such, and considering the relevance of the different resources and outputs included in those efficiency DEA models, it was considered paramount to impose weight restrictions, in order to ensure their discriminative ability, while still ensuring meaningful and realistic DEA results (Podinovski, 2004; S. P. Santos & Amado, 2014). The need to impose weight restrictions also stemmed from the ACT local branches legal obligation to perform all the foreseen activities, to provide all the respective outputs and to prevent all types of accidents at work, irrespectively of their severity level (Portuguese Government, 2000a, 2001b, 2007c, 2012c, Portuguese Parliament, 2009a, 2009c, 2009d), regardless of the relative level of efficiency or effectiveness associated to their production. Otherwise, the optimization procedure would lead to an excessive and undesirable specialization, atributing null weights to the outputs and outcomes produced in very low quantities, resulting in an incorrect efficiency and effectiveness scores. As discussed by Rogge (2012), with reference to a different context, it is important that the DEA assessment does not create incentives for an excessive specialization of the DMUs. Moreover, the inclusion of weight restrictions was also necessary to distinguish the various inputs relative relevance, to differentiate the various outputs according to its complexity or level of resources consumed in its provision, to stress the different social value of the different outcomes, as well as to incorporate some ‘rules of businesses’ or production processes specificities into de DEA models. The latter include, for example, the fact that; only labour inspectors have the legal powers to conduct inspection visits, to carry out work-related accidents inquiries and to issue inspection procedures (ACT, 2015f, 2015h, Portuguese Government, 2000a, 2001b, 2007c; Portuguese Parliament, 2009c); only labour inspectors and technical officials are entitled to instruct labour administrative infringement proceedings (ACT, 2016f; Portuguese Government, 2001b; Portuguese Parliament, 2014b); only labour inspectors, technical officials and technical assistants can ensure the written, phone and face-to-face local information and technical advice services; for safety and evidence reasons, the inspection visits are carried as a rule, by at least two labour inspectors (ACT, 2015f).

According to the reasoning discussed above, the input, output and outcome weight restrictions described in Table 15 were imposed to the three DEA models.

DEA Model 1 - Resource Efficiency		DEA Model 2 - Cost Efficiency		DEA Model 3 - Effectiveness
WR1: $V_1 - V_2 \geq 0$	WR31: $100U_{13} - U_{12} \geq 0$	WR60: $U_1 - U_2 \geq 0$	WR90: $100U_5 - U_1 \geq 0$	WR115: $U_{14} - 210U_{15} \geq 0$
WR2: $V_2 - V_3 \geq 0$	WR32: $100U_2 - U_1 \geq 0$	WR61: $U_2 - U_3 \geq 0$	WR91: $100U_6 - U_1 \geq 0$	WR116: $U_{15} - 40U_{16} \geq 0$
WR3: $V_3 - V_4 \geq 0$	WR33: $100U_3 - U_1 \geq 0$	WR62: $U_3 - U_4 \geq 0$	WR92: $20,000U_7 - U_1 \geq 0$	WR117: $210,000U_{15} - U_{14} \geq 0$
WR4: $V_1 - V_5 \geq 0$	WR34: $100U_4 - U_1 \geq 0$	WR63: $U_4 - U_5 \geq 0$	WR93: $100U_8 - U_1 \geq 0$	WR118: $8,400,000U_{16} - U_{14} \geq 0$
WR5: $U_1 - U_2 \geq 0$	WR35: $100U_5 - U_1 \geq 0$	WR64: $U_5 - U_6 \geq 0$	WR94: $100U_3 - U_2 \geq 0$	WR119: $40,000U_{16} - U_{15} \geq 0$
WR6: $U_2 - U_3 \geq 0$	WR36: $100U_6 - U_1 \geq 0$	WR65: $U_6 - U_8 \geq 0$	WR95: $100U_4 - U_2 \geq 0$	
WR7: $U_3 - U_4 \geq 0$	WR37: $20,000U_7 - U_1 \geq 0$	WR66: $U_8 - 200U_7 \geq 0$	WR96: $100U_5 - U_2 \geq 0$	
WR8: $U_4 - U_5 \geq 0$	WR38: $100U_8 - U_1 \geq 0$	WR67: $U_8 - 3U_9 \geq 0$	WR97: $100U_6 - U_2 \geq 0$	
WR9: $U_5 - U_6 \geq 0$	WR39: $100U_3 - U_2 \geq 0$	WR68: $U_9 - U_{10} \geq 0$	WR98: $20,000U_7 - U_2 \geq 0$	
WR10: $U_6 - U_8 \geq 0$	WR40: $100U_4 - U_2 \geq 0$	WR69: $U_{10} - U_{11} \geq 0$	WR99: $100U_8 - U_2 \geq 0$	
WR11: $U_8 - 200U_7 \geq 0$	WR41: $100U_5 - U_2 \geq 0$	WR70: $U_{11} - U_{12} \geq 0$	WR100: $100U_4 - U_3 \geq 0$	
WR12: $U_8 - 3U_9 \geq 0$	WR42: $100U_6 - U_2 \geq 0$	WR71: $U_{12} - U_{13} \geq 0$	WR101: $100U_5 - U_3 \geq 0$	
WR13: $U_9 - U_{10} \geq 0$	WR43: $20,000U_7 - U_2 \geq 0$	WR72: $300U_9 - U_8 \geq 0$	WR102: $100U_6 - U_3 \geq 0$	
WR14: $U_{10} - U_{11} \geq 0$	WR44: $100U_8 - U_2 \geq 0$	WR73: $300U_{10} - U_8 \geq 0$	WR103: $20,000U_7 - U_3 \geq 0$	
WR15: $U_{11} - U_{12} \geq 0$	WR45: $100U_4 - U_3 \geq 0$	WR74: $300U_{11} - U_8 \geq 0$	WR104: $100U_8 - U_3 \geq 0$	
WR16: $U_{12} - U_{13} \geq 0$	WR46: $100U_5 - U_3 \geq 0$	WR75: $300U_{12} - U_8 \geq 0$	WR105: $100U_5 - U_4 \geq 0$	
WR17: $300U_9 - U_8 \geq 0$	WR47: $100U_6 - U_3 \geq 0$	WR76: $300U_{13} - U_8 \geq 0$	WR106: $100U_6 - U_4 \geq 0$	
WR18: $300U_{10} - U_8 \geq 0$	WR48: $20,000U_7 - U_3 \geq 0$	WR77: $100U_{10} - U_9 \geq 0$	WR107: $20,000U_7 - U_4 \geq 0$	
WR19: $300U_{11} - U_8 \geq 0$	WR49: $100U_8 - U_3 \geq 0$	WR78: $100U_{11} - U_9 \geq 0$	WR108: $100U_8 - U_4 \geq 0$	
WR20: $300U_{12} - U_8 \geq 0$	WR50: $100U_5 - U_4 \geq 0$	WR79: $100U_{12} - U_9 \geq 0$	WR109: $100U_6 - U_5 \geq 0$	
WR21: $300U_{13} - U_8 \geq 0$	WR51: $100U_6 - U_4 \geq 0$	WR80: $100U_{13} - U_9 \geq 0$	WR110: $20,000U_7 - U_5 \geq 0$	
WR22: $100U_{10} - U_9 \geq 0$	WR52: $20,000U_7 - U_4 \geq 0$	WR81: $100U_{11} - U_{10} \geq 0$	WR111: $100U_8 - U_5 \geq 0$	
WR23: $100U_{11} - U_9 \geq 0$	WR53: $100U_8 - U_4 \geq 0$	WR82: $100U_{12} - U_{10} \geq 0$	WR112: $20,000U_7 - U_6 \geq 0$	
WR24: $100U_{12} - U_9 \geq 0$	WR54: $100U_6 - U_5 \geq 0$	WR83: $100U_{13} - U_{10} \geq 0$	WR113: $100U_8 - U_6 \geq 0$	
WR25: $100U_{13} - U_9 \geq 0$	WR55: $20,000U_7 - U_5 \geq 0$	WR84: $100U_{12} - U_{11} \geq 0$	WR114: $20,000U_7 - U_8 \geq 0$	
WR26: $100U_{11} - U_{10} \geq 0$	WR56: $100U_8 - U_5 \geq 0$	WR85: $100U_{13} - U_{11} \geq 0$		
WR27: $100U_{12} - U_{10} \geq 0$	WR57: $20,000U_7 - U_6 \geq 0$	WR86: $100U_{13} - U_{12} \geq 0$		
WR28: $100U_{13} - U_{10} \geq 0$	WR58: $100U_8 - U_6 \geq 0$	WR87: $100U_2 - U_1 \geq 0$		
WR29: $100U_{12} - U_{11} \geq 0$	WR59: $20,000U_7 - U_8 \geq 0$	WR88: $100U_3 - U_1 \geq 0$		
WR30: $100U_{13} - U_{11} \geq 0$		WR89: $100U_4 - U_1 \geq 0$		

Table 15 – Weight restrictions imposed to the efficiency and effectiveness DEA models

Source: Own elaboration

To avoid that the resulting DEA models, although providing better results discrimination, may not represent realistic improvement factors, the method used to the construction of the necessary weight restrictions was the Podinovski (2004) trade-off approach. By converting realistic production technology trade-offs into equivalent weight restrictions, this method ensures that the radial targets of inefficient units are always producible and the relative efficiency measure holds its traditional meaning, as a realistic radial improvement factor (Podinovski, 2004:1311).

Accordingly, the DEA Model 1 restrictions WR1 to WR4, for example, are intended to establish meaningful and realistic production trade-offs between inputs. WR1, for instance, states that if the number of technical officials decreases by one and the number of labour inspectors increases by one, the outputs should not be undermined (e.g., in terms of the resulting number of inspection visits, number of inspection procedures issued, number of work-related accidents inquiries conducted, etc). The underlying assumption is that the work carried out by the technical official can also be performed by the labour inspector, but the opposite is not true (Portuguese Government, 2000a, 2001b; Portuguese Parliament, 2014b). The same rational applies to the WR2 and WR3.

WR4, on the other hand, states that if the number of service cars of a given ACT local branch decreases by one and the number of its labour inspectors increases by one, the outputs should not be harmed, being the underlying assumption the fact that the inspection visits can be done without service cars (in particular in urban areas well served by public transport), but not without labour inspectors. As for the output weight restrictions, aimed at establishing production trade-offs likely to incorporate in the model the complexity of each output provision (either in terms of the needed time, staff category required, level and type of resources needed or inherent costs), WR5, for example, assumes that if an ACT local branch increases the number of suspension notices issued by one and decreases by one the number of work-related accidents inquiries undertaken, it should not need any additional resources, or its operational costs should not rise (WR60). These weight restrictions are based on the assumption that conducting an work-related accident inquiry is more time, resource and cost demanding than issuing a suspension notice, taking into account the number of inspection visits it requires, the number of people to interview, the amount of evidence to collect and analyse and the number of inspection procedures it usually requires to be issued and monitored. Moreover, WR12, for example, states that if an ACT local branch increases by 3 the number of workers covered during an inspection visit and decreases by one the number of inspection visits carried out, it should not consume more resources, or its operational costs should not rise (WR67). These weight restriction are based no only on the fact that an inspection visit covers, on average, a minimum number of 3 workers, but also on the assumption that the number of infractions detected and, therefore, the level of the outputs related to the corresponding inspections procedures issued (and, consequently, the resources consumed or the costs supported) vary more according to the number of visits conducted than to the number of workers covered. In addition, and following the need to include a non-controllable output (size of the ACT local branch jurisdiction area), it became necessary to establish realistic production trade-offs which accounted for the impact of the size of the local services jurisdiction areas on the number of inspection visits to be performed. This production trade-offs were imposed through the weigh restrictions WR11 (in the resource efficiency model) and WR66 (in the cost efficiency model). They assume that if an ACT local branch has to go through 200 square kilometers or more of its jurisdiction area but performs one fewer visit, it should not need additional resources (WR11) or its operational costs should not rise (WR66). This restriction is justified by the fact that if an ACT local branch has to cover a jurisdiction area greater

in 200 square kilometers, this may justify the performance of one fewer visit, due to the time spent in the respective journeys. This assumption is consistent, moreover, with the estimated linear regression equation ($\hat{Y} = 126.97 + 0.005436X$) between the dependent variable ‘number of inspection visits’ (Y) and the independent variable ‘size of the jurisdiction area, in square kilometers’ (X). Furthermore, it was necessary to introduce several weight restrictions in the effectiveness DEA model in order to capture the different inherent value of each outcome for the ACT stakeholders and for the society in general, based on the presumed social costs resulting from their different severity levels. This was the case of the weight restriction WR115, which assumes that if an ACT local branch increases by 210 the number of prevented non-fatal work-related accidents per 100,000 workers (in relation to the respective EU 28 benchmark) but decreases by one the number of prevented fatal work-related accidents per 100,000 workers (in relation to the respective EU 28 benchmark), the associated social costs would not increase. This trade-off is based on the assumption that the overall (to the victim and their family members, to the employer and to the State) social costs (non-financial human costs, lost family income, healthcare and administrative costs, employer’s productivity costs, state loss of tax and social security receipts, increase of state benefit costs) of a fatal work-related accident correspond to the overall social costs of 210 non-fatal work-related accidents, as provided for in HSE (2015:17). The same also applies to the weight restriction WR116, which states that if an ACT local branch increases by 40 the number of prevented days of absence from work per 100,000 workers (in relation to the respective EU 28 benchmark) but decreases by one the number of prevented non-fatal work-related accidents per 100,000 workers, the associated social costs would not rise. The latter is based on the finding that the average number of days of absence from work per non-fatal work-related accident in the continental territory of Portugal in 2013, was approximately 40 days (40 days = 4,627,087 days of absence / 117,097 non-fatal accidents at work) (GEP, 2015:28,33,92-94). Finally, and in order to avoid an undesirable specialization in some outputs, preventing the local branches to specialize exclusively in the provision of the one (or few) outputs in which production they might be relatively more efficient and to assign zero weights to the remaining, it became necessary, as mentioned above, to impose the weight restrictions WR17 to WR59 and WR72 to WR114. These weight restrictions are based on the assumption that, although the production of each output implies the consumption of different levels of resources or supporting different levels of costs, the production of an output can not, under any circumstance, involve

consuming a level of resources or supporting a level of costs 100 times higher than the production of any other output. According to these weight restrictions, not only no local branch can assign a weight to an output greater than 100 times the weight assigned to another output but also all local branches have to present weights above zero for all outputs (Dyson et al., 2001). In the specific case of the effectiveness model, the same rationale was also applied through the weight restrictions WR117 to WR119, which state that an ACT local branch cannot benefit from the assignment of a weight to an outcome which is more than 1,000 times greater than the weight assigned to another outcome. The underlying assumption is two-fold. On the one hand, as the ACT local branches have the legal obligation to prevent all types of accidents at work, irrespectively of its severity level (which, of course, does not mean that they should be treated as equal or tackled on the basis of the same strategic approach), they can not be specialized exclusively in the provision of one (or few) outcomes (in which they might be relatively more effective) at the expense of not providing one or more of the remaining. On the other hand, and in spite of the recognition that the more serious an accident at work is the higher will likely be its social costs, it is not reasonable to assume, under any circumstances, that society perceives the prevention of a certain type of accident at work as being more than 1,000 times more relevant than the prevention of another type of work-related accident.

5.4 Results presentation and discussion

The main results of the research on this topic, derived from the resource efficiency, cost efficiency and effectiveness DEA models, under the assumptions of both CRS and VRS, are summarized in Table 16.

These results suggest that the ACT has a considerable scope for both efficiency and effectiveness improvement.

They also indicate that the ACT efficiency and effectiveness varies considerably across its local branches, thus leveraging the added value of sharing the learning benchmarks best practices with the inefficient and ineffective local branches.

DMU		DEA Model 1 - Resource Efficiency						DEA Model 2 - Cost Efficiency						DEA Model 3 - Effectiveness		
		CRS		VRS		CRS/VRS	CRS		VRS		CRS/VRS	CRS or VRS				
No.	ACT local branch	TE Score (%)	Benchmarks	$\sum \lambda_j$	PTE Score (%)	Benchmarks	SE Score (%)	TE Score (%)	Benchmarks	$\sum \lambda_j$	PTE Score (%)	Benchmarks	SE Score (%)	TE & PTE Scores (%)	Benchmarks	
1	Almada	67.46	3; 30	1.35	73.92	3; 22; 26; 30	91.27	52.02	10; 24; 30	1.56	60.64	22; 24; 26; 30	85.78	83.59	8; 26	
2	Aveiro	100.00	[# 2]		100.00	[# 2]	100.00	93.06	7; 10	4.13	100.00	[# 7]	93.06	63.99	8	
3	Barreiro	100.00	[# 13]		100.00	[# 7]	100.00	98.57	10; 24	1.33	100.00	[# 1]	98.57	91.68	26	
4	Beja	56.86	7; 24	1.63	63.04	3; 7; 15; 24	90.20	47.51	7; 24	1.69	57.01	7; 15; 24	83.34	85.20	8; 26	
5	Braga	66.48	2; 3; 10; 30; 32	1.83	69.36	2; 3; 22; 30; 32	95.85	50.50	7; 10	5.06	62.36	2; 22; 24; 30	80.98	88.66	10; 28	
6	Bragança	84.29	11; 24; 29	0.55	100.00	[# 0]	84.29	52.23	10; 24	0.94	53.64	10; 24	97.38	60.55	26	
7	Caldas da Rainha	100.00	[# 7]		100.00	[# 4]	100.00	100.00	[#10]		100.00	[# 5]	100.00	61.32	8	
8	Castelo Branco	92.30	3; 24	0.73	100.00	[# 0]	92.30	75.06	24	0.77	80.48	7; 10; 24	93.27	100.00	[#14]	
9	Coimbra	66.84	3; 17; 29; 32	1.58	73.71	22; 24; 32	90.67	40.72	10; 32	6.00	56.97	2; 22; 24; 32	71.48	87.39	8	
10	Covilhã	100.00	[# 4]		100.00	[# 3]	100.00	100.00	[# 22]		100.00	[# 8]	100.00	100.00	[# 7]	
11	Évora	100.00	[# 2]		100.00	[# 0]	100.00	71.04	10; 24	1.88	75.08	10; 24; 30; 32	94.63	94.04	26; 28	
12	Faro	75.74	3; 24; 29; 30; 32	1.42	82.10	3; 22; 24; 30; 32	92.26	54.88	10; 24; 30	2.79	67.04	22; 24; 30; 32	81.87	89.69	10; 28	
13	Figueira da Foz	90.79	3; 7; 24	0.48	100.00	[# 0]	90.79	66.17	7; 10; 24	0.84	71.34	7; 10; 16; 24	92.75	73.87	8	
14	Guarda	69.46	3; 7; 24	1.02	69.89	3; 7; 15; 24	99.39	47.80	7; 10; 24	1.71	51.84	2; 15; 24; 30	92.20	86.08	8	
15	Guimarães	96.18	7; 10; 24	1.75	100.00	[# 2]	96.18	79.79	7; 10; 24	2.11	100.00	[# 3]	79.79	94.23	28	
16	Lamego	79.83	3; 7; 24	0.43	100.00	[# 0]	79.83	71.47	7; 24	0.42	100.00	[# 1]	71.47	92.03	8	
17	Leiria	100.00	[# 2]		100.00	[# 1]	100.00	69.99	10; 24; 30	3.33	86.62	2; 22; 30; 32	80.81	74.87	8; 26	
18	Lisboa	77.30	10; 22; 30; 32	3.41	89.33	22	86.53	50.80	10; 30	11.22	89.33	22	56.87	89.24	28	
19	Penafiel	69.36	2; 3; 7; 30	0.94	69.38	2; 3; 7; 10; 30	99.98	62.32	10; 24	1.59	64.19	2; 3; 24; 30	97.08	60.46	8	
20	Portalegre	75.54	3; 11; 24	0.50	100.00	[# 0]	75.54	43.33	7; 10; 24	1.17	43.90	2; 7; 10; 24	98.70	56.10	8; 26	
21	Portimão	86.87	10; 24; 30	0.71	91.41	10; 24; 30	95.04	75.44	10; 24; 30	0.70	77.14	10; 24; 30	97.80	80.49	8	
22	Porto	100.00	[# 1]		100.00	[# 6]	100.00	76.17	10	11.59	100.00	[# 9]	76.17	90.03	10; 28	
23	Santarém	97.89	3; 17; 24; 30; 32	1.04	98.15	17; 22; 24; 30; 32	99.73	77.08	10; 24; 30	1.47	87.30	22; 24; 26; 30	88.29	62.19	8	
24	São João da Madeira	100.00	[# 13]		100.00	[# 7]	100.00	100.00	[# 22]		100.00	[# 19]	100.00	95.59	28	
25	Setúbal	100.00	[# 0]		100.00	[# 0]	100.00	78.12	10; 24; 30	1.73	93.58	22; 24; 30	83.48	64.94	28	
26	Sintra	100.00	[# 0]		100.00	[# 1]	100.00	83.46	24; 30	1.83	100.00	[# 2]	83.46	100.00	[#8]	
27	Tomar	85.72	3; 24; 32	0.56	100.00	[# 0]	85.72	56.00	7; 10; 24	1.32	57.69	2; 10; 24; 32	97.07	84.41	10; 28	
28	Torres Vedras	94.56	3; 7; 24; 30	0.83	97.08	3; 7; 10; 24; 30	97.41	80.57	10; 24; 30	1.13	81.27	10; 24; 30; 32	99.14	100.00	[#12]	
29	Viana do Castelo	100.00	[# 3]		100.00	[# 0]	100.00	74.37	10; 24	1.33	79.49	22; 24; 32	93.55	82.86	10; 28	
30	Vila Franca de Xira	100.00	[# 8]		100.00	[# 7]	100.00	100.00	[# 9]		100.00	[# 11]	100.00	64.50	10; 28	
31	Vila Real	100.00	[# 0]		100.00	[# 0]	100.00	71.97	7; 24	1.07	74.09	7; 15; 24	97.14	91.38	10; 28	
32	Viseu	100.00	[# 6]	1.35	100.00	[# 4]	100.00	100.00	[# 1]	1.56	100.00	[# 7]	100.00	91.89	8; 26	
Number of efficient/effective branches		14			21		14	5			11		5	4		
% of efficient/effective branches		43.75			65.63		43.75	15.63			34.38		15.63	12.50		
% of below average scores branches		40.63			28.13		37.50	46.88			46.88		40.63	37.50		
Scores average (%)		88.55			93.04		95.09	71.89			80.34		89.57	82.54		
Scores Std. Dev. (%)		13.61			12.04		6.71	18.67			18.28		10.66	13.78		
Scores Max. (%)		100.00			100.00		100.00	100.00			100.00		100.00	100.00		
Scores Min. (%)		56.86			63.04		75.54	40.72			43.90		56.87	56.10		

Table 16 – ACT local branches relative resource efficiency, cost efficiency and effectiveness scores, benchmarks and sum of the respective CRS scale multipliers

Source: Own elaboration, based on the EMS outputs.

Notes: TE - Technical Efficiency/Effectiveness (CRS); PTE - Pure Technical Efficiency/Effectiveness (VRS); SE - Scale Efficiency (CRS/VRS).

5.4.1 Efficiency

5.4.1.1 Technical cost efficiency

This research results show that when comparing all branches to each other, irrespectively of their size, there are only 5 ACT local branches (about 16% of the total) which are technically cost efficient (Caldas da Rainha, Covilhã, São João da Madeira, Vila Franca de Xira and Viseu) (see Table 16 and Appendix 12.3).

They also indicate that the average technical cost efficiency score of the ACT local branches is about 72%, with a standard deviation of around 19% and 15 local branches (47% of the total) presenting technical cost efficiency scores below average. Considering the output orientation of the cost efficiency model, it means that, taking into account the costs of each delegation, they should be able to produce more 39% of outputs.

Besides a wide scope for cost efficiency improvement, the results also suggest a considerable variability across the territory, which might leverage the added value of sharing the learning benchmarks best practices with the cost inefficient local branches. Concerning the latter, Table 16 also shows that the more robust technically cost efficient ACT local branches, whose best practices are learning benchmarks for a larger number of inefficient ones, are the Covilhã and the São João da Madeira local branches. Their best practices are learning paths for 22 inefficient branches. Together, Covilhã and São João da Madeira ACT branches are learning benchmarks for all the inefficient branches, as all inefficient branches have either Covilhã or São João da Madeira branches, or both, as benchmarks.

In order to better understand the strengths and weaknesses of a technically cost inefficient local branch and to identify possible improvement paths for its cost inefficiency, on the basis of its benchmarks best practices, it is worth to compare the output levels per €100 thousand of operational costs of a technically cost inefficient branch with the ones of its benchmarks, as illustrated in Figure 8. It compares the production pattern of the cost inefficient branch of Viana do Castelo with the ones of the Covilhã and the São João da Madeira branches, which are its benchmarks. The analysis of Figure 8 allow us to see that the former follows roughly the generic pattern of the latter, especially the one of the Covilhã branch, whereas the main difference appears to be the substantial difference between the output levels per €100 thousand of operational costs presented by the Viana do Castelo branch, when compared to the ones of its benchmarks.

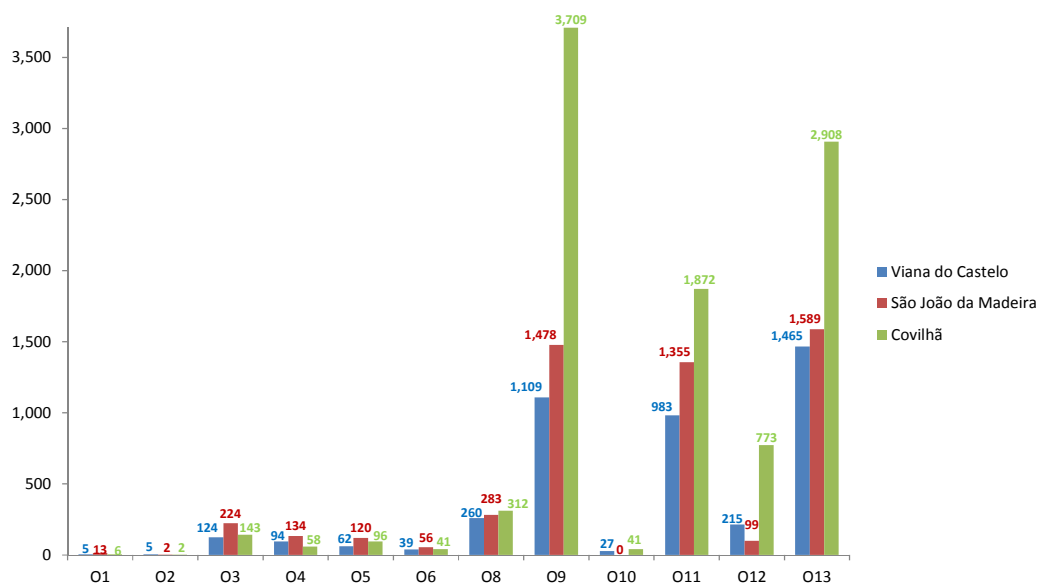


Figure 8 - Comparing the output levels per €100 thousand of operational costs of the Viana do Castelo branch with its learning benchmarks

Source: Own elaboration, based on *EMS* outputs

In this context, it assumes especial relevance to estimate the output levels needed for the Viana do Castelo branch to achieve technical cost efficiency, with a view to better calibrate its efforts and to guide its resources allocation. These output targets, that Viana do Castelo has to achieve to become technically cost efficient, can be estimated, for each output (as shown in Table 17, on the basis of the *EMS* outputs exhibited in Appendix 12.3), by means of the sum of the products between the level of each benchmark for that particular output and the corresponding λ_j scale multiplier of the Viana do Castelo branch for that benchmark.

Description		Benchmark outputs		Viana do Castelo outputs			
		Covilhã ($\lambda_j = 0.31638803$)	São João da Madeira ($\lambda_j = 1.01500164$)	Actual output levels	Targets to achieve cost efficiency	Outputs improvement level needed	
						Absolute value	(%)
O1	WRAINQ	11	58	27	62	35	129.6
O2	SUSPNOT	4	8	27	9	-18	-66.7
O3	FINCOL	276	963	616	1,065	449	72.9
O4	INFRNOT	112	575	468	619	151	32.3
O5	IMPRNOT	185	515	307	581	274	89.3
O6	OTHNOT	79	239	192	268	76	39.6
O8	INSPVIS	602	1,214	1,291	1,423	132	10.2
O9	WRKCOVINSP	7,164	6,352	5,513	8,714	3,201	58.1
O10	WRINFSRV	79	0	136	25	-111	-81.6
O11	PRINFSRV	3,615	5,824	4,887	7,055	2,168	44.4
O12	PHINFSRV	1,493	424	1,070	903	-167	-15.6
O13	COVINFAW	5,616	6,829	7,287	8,708	1,421	19.5

Table 17 – Output targets estimation for the Viana do Castelo local branch to become cost efficient

Source: Own elaboration, based on the data displayed on Appendices 9 and 12.3.

As such, to become technically cost efficient, Viana do Castelo branch has to achieve the production levels shown in the antepenultimate column of Table 17, through the implementation of the service level adjustments provided for in the penultimate column.

The pursue of the learning path suggested by the Covilhã and the São João da Madeira branches best practices implies, however, not only a substantial overall increase on the Viana do Castelo branch output levels, but also a resource allocation refocus and, consequently, a considerable change on the absolute and relative output levels of the activities performed, as evidenced in Figure 9.

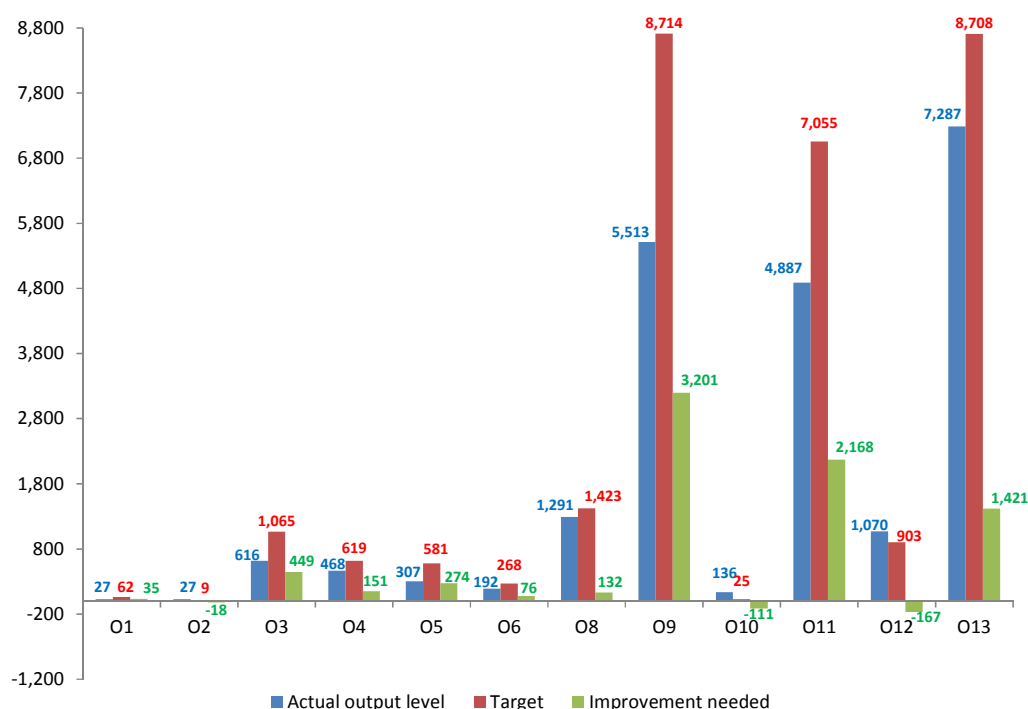


Figure 9 - Viana do Castelo branch improvement of output levels

Source: Own elaboration, based on ACT data and EMS outputs

Indeed, as Figure 9 shows, the adoption of the targets set up for the Viana do Castelo branch on the basis of its benchmarks best practices, is expected to induce a global increase on its output levels. It is also likely to lead to a sizeable increase in several output levels, particularly, in the number of work-related accidents inquiries (O1, around more 130%), number of improvement notices (O5, more 89%), number of collected fines (O3, more 73%) and number of workers covered by the inspection visits (O9, more 58%), to the detriment of the number of people to be informed and advised through the local written and telephone information service (O10 and O12, respectively) and the number of suspension notices (O2), whose output levels are anticipated to suffer a considerable decline (of about 82%, 16% and 67%, respectively).

The strategic refocus of the Viana do Castelo branch, through the adoption of such targets, besides leading to its technical cost efficiency and to become a learning benchmark for 16 local branches, is also likely, *ceteris paribus*, to improve slightly the overall technical cost efficiency score of the ACT (from 71.89% to 72.69%), as can be seen in Appendix 12.4. The Viana do Castelo branch cost efficiency enhancement, however, is expected to require a different resource allocation scheme, the modification of the work methods, systems and processes and, consequently, the need for the development of new internal skills and competencies and/or the adaptation and improvement of existing ones, namely through the training of its staff, as commonly suggested in the generality of management text books (Bartol & Martin, 1998; Bateman & Snell, 2007; Donnelly, Gibson, & Ivancevich, 1998; Ivancevich, Lorenzi, Skinner, & Crosby, 1997; Robbins & Coulter, 1998)

5.4.1.2 Scale cost efficiency

The research results also suggest, when comparing the technical cost efficiency scores with the pure technical efficiency scores (cf. Table 16 and Appendices 12.3 and 12.5), that there are 11 ACT local branches that have pure technical cost efficiency (Aveiro, Barreiro, Caldas da Rainha, Covilhã, Guimarães, Lamego, Porto, São João da Madeira, Sintra, Vila Franca de Xira and Viseu), whereas only 5 are technically cost efficient (Caldas da Rainha, Covilhã, São João da Madeira, Vila Franca de Xira and Viseu). The research findings also indicate that only 5 branches (Caldas da Rainha, Covilhã, São João da Madeira, Vila Franca de Xira and Viseu) are scale cost efficient (i.e. with SE = 100%). Moreover, the results allow seeing that there are several ACT local branches (e.g. Aveiro, Barreiro, Guimarães, Lamego, Porto and Sintra) that, in spite of being managed and organized in a cost efficient manner (i.e., with PTE = 100%), when compared with other local branches of similar size, they are not scale efficiency (i.e., SE < 100%), having therefore potential to improve its (scale) cost efficiency and, consequently, its technical cost efficiency. Building on Sherman & Zhu (2006:141) method for assessing scale efficiency, on the basis of the sum of the inefficient DMU λ_j scale multipliers, Table 16 results suggest that while Lamego branch is too small, presenting Increasing Returns to Scale (IRS), the ACT local branches of Porto, Aveiro, Guimarães, Sintra and Barreiro are too large, showing Decreasing Returns to Scale (DRS). In this context, the ACT local branch of Lamego would benefit, in terms of cost efficiency per-

formance, if it was larger, while the ACT local branches of Porto, Aveiro, Guimarães, Sintra and Barreiro would benefit if their size was smaller. In addition, Table 16 results suggest the existence of 21 ACT local branches that are neither pure technically cost efficient nor scale cost efficient (e.g. Almada, Beja, Braga, Bragança, Castelo Branco, Coimbra, Évora, Faro, Figueira da Foz, Guarda, Leiria, Lisboa, Penafiel, Portalegre, Portimão, Santarém, Setúbal, Tomar, Torres Vedras, Viana do Castelo and Vila Real). As such, the enhancement of technical cost efficiency by the latter ACT local branches is likely to require, not only the development of their pure technical cost efficiency, but also the improvement of their scale cost efficiency. In particular, the ACT local branches of Lisboa, Coimbra, Braga, Leiria, Faro, Évora, Setúbal, Guarda, Beja, Penafiel, Almada, Santarém, Viana do Castelo, Tomar, Portalegre, Torres Vedras and Vila Real, being apparently too large and presenting DRS, besides improving their pure technical efficiency, would benefit their scale cost efficiency (and, ultimately, their technical cost efficiency) if their size were smaller. In the case of the local branch of Torres Vedras, however, the potential to improve its technical cost efficiency is essentially on the pure technical efficiency, since its scale efficiency is very close to the 100%. On the other hand, the ACT local branches which size appears to be too small, presenting IRS (Portimão, Castelo Branco, Figueira da Foz and Bragança) might improve their technical cost efficiency either through the development of their pure technical cost efficiency, the increase of their size (namely through the merger with other smaller and adjacent branches), or both. Furthermore, when comparing the ACT local branches according to their size (cf. Table 16 and Appendix 12.5), the ACT branches whose pure technical cost efficiency best practices are learning benchmarks for a larger number of inefficient units are São João da Madeira (benchmark for 19 branches) and Vila Franca de Xira (benchmark for 11 branches). Except for the Lisbon branch (which might learn with ACT Porto branch), all the other pure technically cost inefficient branches have either São João da Madeira or Vila Franca de Xira branches, or both, as learning benchmarks

5.4.1.3 Cost efficiency drivers

Regarding the cost efficiency drivers, the results of the exploratory analysis carried out (as shown in Appendix 13) suggest that the ACT local branches cost efficiency is, *ceteris paribus*, as lower as higher is: a) the average annual cost with the remuneration of the labour inspectors ($r = -0.58$; $p\text{-value} = 0.0005$); b) the average seniority (in years)

of the staff in the current career ($r = -0.54$; $p = 0.0013$), especially in the case of the labour inspectors ($r = -0.52$; $p = 0.0022$); and c) the size of the local branch jurisdiction area in square kilometers ($r = -0.39$; $p = 0.0284$). As for the negative impact of the average annual cost with the remuneration of the labour inspectors in the ACT local branches technical cost efficiency, it seems to reflect the fact that the labour inspectors are the most expensive human resource of the ACT local branches. In fact, the costs with the labour inspectors salary and social charges are, on average, about 329% higher than the ones of the operational assistants, 75% higher than the ones of the technical assistants and around 34% higher than the ones of the technical officials. Indeed, and besides having an higher index (on the wages grading scale) than the other staff categories in comparable situations, thus earning a higher salary, the labour inspectors are also entitled to a remuneration supplement, the Inspection Function Supplement, in the amount of 22,5% of their wage, as a compensation for the specific burdens inherent to their exercise (Portuguese Government, 2001a). These burdens include not only their daily exposure to several different occupational risks (when carrying out inspection visits to workplaces), but also the need for being permanently available (at any time of the day or night, including the weekly rest days and holidays) and their subjection to a legal incompatibilities regime which is substantially more restrictive than the one applicable to the majority of the Portuguese civil servants (Portuguese Government, 2000a). Moreover, this result is consistent with the fact that the cost efficient local branches use a number of labour inspectors which is about 27% lower than the number of labour inspectors used by the cost inefficient local branches, thus presenting an average annual cost with the remuneration of the labour inspectors which is around 14% lower than the one shown by the cost inefficient local branches. Furthermore, the negative correlation between the staff seniority (especially in the case of the labour inspectors seniority) and the cost efficiency of the ACT local branches, seems to reflect the circumstance that in the Portuguese public administration in general (and in the ACT in particular), the higher the staff seniority for a given career the greater is likely to be its remuneration (and, therefore, its costs). This result, moreover, finds support in the findings of the human capital theory, which sustains that job tenure (i.e., length of time spent in a job) is protected by seniority rights (Becker, 1975; Mincer, 1974) which comprise, among other things, the attribution of seniority premiums to compensate previous work effort, which leads to senior workers earning more than their junior counterparts (Anton, 1992). This is particularly true in the case of the labour inspectors, whose remuneration, as seen

above, is higher than the one earned by the other ACT officials. This situation results from the fact that the promotions in the Portuguese public administration were automatic, essentially based on service time, rather than on the level of individual performance, until they were frozen, in August 2005 (Portuguese Parliament, 2005). These findings are also consistent with the fact that the cost efficient local branches staff average seniority is about 28% lower than the average seniority of the staff of the cost inefficient local branches. In addition, they are also in line with the fact that the average seniority of the labour inspectors of the cost efficient branches is about 34% lower than the average seniority of the labour inspectors assigned to the cost inefficient local branches. As for the negative effect of the size of the local branches jurisdiction areas (in square kilometers) on their cost efficiency, this research results suggest that the jurisdiction areas size do matter. Indeed, the negative impact of the local branches jurisdiction areas size on their cost efficiency seems to find support on the fact that the cost efficient local branches present an average jurisdiction area size which is about 38% lower than the average jurisdiction area size of the ACT local branches and around 42% less than the average jurisdiction area size of the cost inefficient local branches. This finding, on the other hand, are also in line with the expected impact of size on the increase of the service travelling costs, as well as with the possibility of imposing important constraints, not only to the the number of visits likely to be performed but also, as a consequence, to the achievable output levels of the activities that require travelling. In fact, and as expected, considering the coefficient (-0.0054) of the independent variable 'size of the jurisdiction area in square kilometers' ($p\text{-value} = 0.01$) in its estimated linear regression equation with the dependent variable 'number of inspection visits', the results allow seeing that the cost efficient branches carry out, on average, less inspection visits than the cost inefficient branches: around -21% inspection visits than the ACT local branches average number of inspection visits; and about -23% inspection visits than the ones performed by the cost inefficient local branches. Consequently, as suggested, when compared to the cost inefficient branches, the cost efficient local branches show, on average, a lower output level regarding the activities that most require travelling (e.g. -22% of inspected employers, -23% of inspected workplaces, -12% of workers covered by inspection visits, -24% of suspension notices, -40% of notifications to other authorities and -2% of infraction notices). Notwithstanding the lower levels presented by the cost efficient branches for the abovementioned outputs, they are cost efficient because, with less operational costs, they manage to exceed the cost inefficient branches output levels

per unit cost, through the adoption of a strategy focused, on the one hand, on the provision of outputs that require less travelling (and thus lower costs) and, on the other hand, on the maximization of the outputs associated with the (lower) number of inspection visits carried out. Indeed, and in spite the fact that the cost efficient local branches carry out -23% inspection visits than the ones performed by the cost inefficient local branches (thus covering -12% of workers than the cost inefficient branches), they manage to present an average number of workers covered by inspection visit which is about 31% higher than the one presented by the cost inefficient branches, through the targeting of larger employers. In addition, the cost efficient local branches also excel the cost inefficient ones in the provision of several types of outputs (namely in the ones requiring less inspection visits), such as: number of warning notices (+30%); number of improvement notices (+22%); number of work-related accidents inquiries (+45%); number of other notifications (+8%); number of fines collected (+4%); and number of persons served by the local face-to-face information and technical advice services (+20%). Furthermore, the results of this exploratory analysis also suggest that the ACT local branches cost efficiency is, *ceteris paribus*, as higher as the average number of training hours of the staff ($r = 0.48$; $p = 0.0052$), especially in the case of the labour inspectors ($r = 0.39$; $p = 0.0274$). These results are consistent with the finding that the cost efficient branches show an average number of training hours of the staff which is about 94% higher than the one showed by the ACT local branches average and around 136% higher than the one presented by the cost inefficient branches. They are also consistent with the fact that the cost efficient local branches present an average number of training hours of the labour inspectors which is about 59% higher than the one showed by the ACT local branches average and around 78% higher than the one showed by the cost inefficient branches. These findings are also supported by the results of several recent research studies, which found statistically significant positive effects of staff training on task efficiency (Tabassi, Ramli, & Bakar, 2012), organizational efficiency (Shaffer & Dalton, 2014) projects efficiency (Cynthia Alejandra, Karla Paola, & Yesenia, 2015), service performance (MacKelprang, Jayaram, & Xu, 2012) and job performance (Lin & Hsu, 2017), either through job specific training and training in quality management techniques (MacKelprang et al., 2012), learning factories (Krückhans et al., 2015) and on-job training (Lin & Hsu, 2017), even considering the training costs and the training impact on wages (Tripier, 2011). These results, moreover, are in line with the relevance that has long been acknowledged to training in the management literature, as one of the

tasks and responsibilities of management, in particular, as an important practice and managing tool to develop and update the workers skills and competencies to meet the needs of the organizations, as well as to align individual and collective behaviour and performance with their strategies and goals (Drucker, 1946, 1954, 1974, Kaplan & Norton, 1992, 1996, 2000, 2006, Mintzberg, 1973, 1980; Peters & Waterman, 1982). It is recognized as an important management practice in areas such as, inter alia: human resources management and development (Appleby & Mavin, 2000; Barosa-Pereira, 2007; Bartlett & Ghoshal, 2002; Camara, Guerra, & Rodrigues, 1997; Dent, Macgregor, & Wills, 1994; Herzberg, 1966; Holland, 1985; Jones, 2000; Kanter, 1977, 1984; Mathews, 2006; Montier, Alai, & Kramer, 2006; Mumford, 1993; Sallie-Dosunmu, 2006; Schein, 1990; Semler, 1993; Sieff, 1990; Werther & Davis, 1983); organizational learning and knowledge management (Argyris, 1957, 1990, 1991, 1993a, 1993b; Argyris, Putnam, & Smith, 1985; Argyris & Schön, 1974, 1978, 1995; Bartlett & Ghoshal, 2002; Cunningham, 1994; Garvin, 1993; Geus, 1997; Koulopoulos, Spinello, & Wayne, 1997; Leonard-Barton, 1995; Newman, 2006; Pedler, Burgoyne, & Boydell, 1991; Senge, 1990; Senge, Roberts, Ross, Smith, & Kleiner, 1994; Sveiby, 1997; Vargas Fernández, 2003; Walker, 2006); quality management and continuous improvement (Crosby, 1979; Dale, 1994; Deming, 1982, 1988; Imai, 1986; Joiner, 1994; Juran, 1988; Oakland, 1995); managing change (Bennis, Benne, & Chin, 1970; Drucker, 1969; Kanter, 1984; Kanter, Stein, & Jick, 1992; Karoly & Panis, 2004; Pascale, 1991; Pascale & Athos, 1986; Peters, 1994; Sarkar, 2007; Vaill, 1990; Watzlawick, Weakland, & Fisch, 1974); coaching (Barosa-Pereira, 2007; Rego, Pina e Cunha, Oliveira, & Marcelino, 2007; Tabassi et al., 2012); mentoring (Mathews, 2006; Tabassi et al., 2012); and resources, competencies and capabilities based competition (Collis & Montgomery, 1995; Conner, 1991; Hamel & Prahalad, 1989; Penrose, 1959; Prahalad & Hamel, 1990; Stalk, Evans, & Shulman, 1992; B. Wernerfelt, 1989; Birger Wernerfelt, 1984). In the specific case of the public services, the relevance recognized to staff training and its positive impact on the public services efficiency, effectiveness and quality as already led to the provision of the legal obligation of both the private and the public employers to ensure vocational and OSH training to their employees in Portugal, as foreseen in the Portuguese labour and OSH regulations (Portuguese Government, 2016; Portuguese Parliament, 2009a, 2009d, 2014b), in particular in the case of the labour inspectors, which is specifically regulated (Portuguese Government, 2000a, 2001a, 2001b, 2004). These results, moreover, are consistent with the widely

acknowledge positive effect of the labour inspectorates' staff training on their performance, especially in the case of the labour inspectors (ILO, 1947, 1969, 2003, 2006c, 2010, 2011a, 2015; Richthofen, 2002; SLIC, 2015a).

5.4.1.4 Technical resource efficiency

Concerning the relative technical resource efficiency of the ACT local branches, the research results indicate (as shown in Table 16 and Appendix 12.1), that there are 14 ACT local branches (about 44% of the total) technically resource efficient (Aveiro, Barreiro, Caldas da Rainha, Covilhã, Évora, Leiria, Porto, São João da Madeira, Setúbal, Sintra, Viana do Castelo, Vila Franca de Xira, Vila Real and Viseu). The research results also show that the ACT average technical resource efficiency score is about 89%, which means that, considering the resources used by the ACT local branches, they should produce, on average, more 12% of outputs. Moreover, the ACT local branches technical resource efficiency scores present a standard deviation of around 14%, with 18 local branches proving to be technically resource inefficient (47% of the total), 13 of which showing technical resource efficiency scores below average. These findings suggest a considerable scope for resource efficiency improvement and a significant variability across the territory which, in turn, increases the interest of promoting the exchange of best practices between the learning benchmarks and the resource inefficient local branches. Furthermore, the most robust technically resource efficient benchmarks, whose best practices may constitute learning paths for a larger number of technically resource inefficient branches, are Barreiro and São João da Madeira branches. Their best practices are benchmarks for 13 resource inefficient branches. With the exception of Lisbon branch (which might learn from the ACT local branches of Porto, Vila Franca de Xira, Viseu and Covilhã), the local branches of Barreiro and São João da Madeira are, together, learning benchmarks for all the technically resource inefficient branches, as all of them have either Barreiro or São João da Madeira branches, or both, as benchmarks (see Table 16).

Moreover, it is interesting to compare the output levels, per labour inspector, of a technically resource inefficient local branch with its benchmarks, in order to understand which possible learning paths the former can follow with a view to improve its technical resource efficiency, as illustrated in Figure 10, regarding the ACT local branch of Beja. The Beja branch is the worse ACT branch in terms of technical resource efficiency (TE

= 56.9%), whose benchmarks are the branches of Caldas da Rainha and São João da Madeira (see Table 16). While Beja has 11 labour inspectors (the same number as São João da Madeira branch), 6 technical officials, 5 technical assistants and 6 cars, the Caldas da Rainha branch uses only 5.33 labour inspectors, 4 technical officials, 3 technical assistants and 2 cars and the São João da Madeira branch uses 11 labour inspectors (the same as Beja), but only 2 technical officials, 3 technical assistants, 1 operational assistant and 4 cars (see Appendix 8).

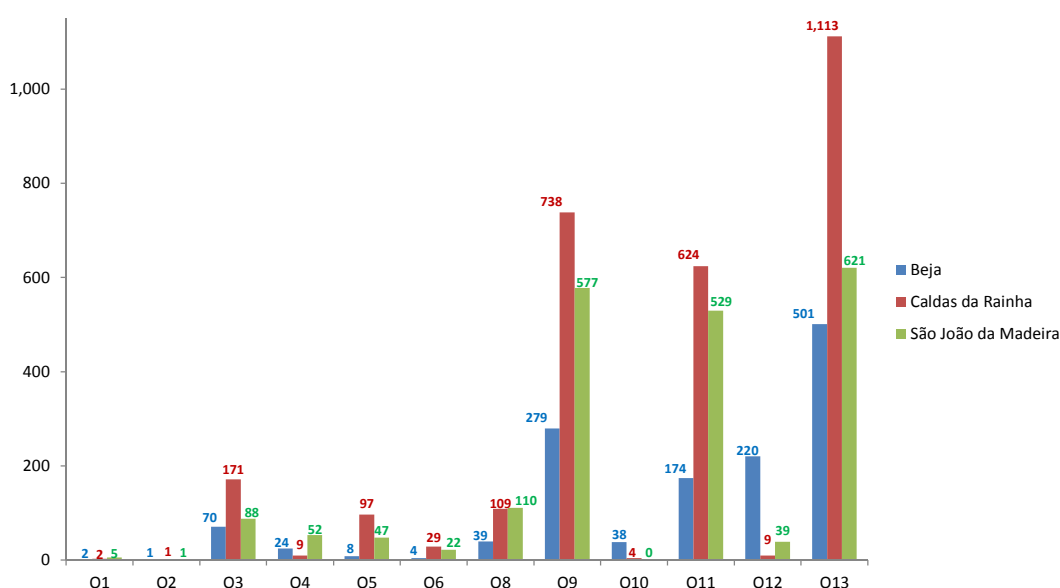


Figure 10 - Comparing the outputs per labour inspector of the Beja local branch with its benchmarks
Source: Own elaboration, based on EMS outputs

Not surprisingly, Figure 10 allows seeing that the Beja local branch, in spite of using more resources than their benchmarks, presents output levels per labour inspector which are considerably lower than the ones showed by its benchmarks, even when compared with the São João da Madeira branch, which has roughly the same size. In fact, and although Beja appears to be focused on the provision of the same type of outputs as its benchmarks, it presents output levels per labour inspector which are substantially lower than their benchmarks, with the exception of the number of persons informed through the local written (O10) and phone (O12) information services, which are the only two services provided by the Beja local branch whose output levels per labour inspector exceeds their benchmarks.

In this context, the improvement of the Beja local branch technical resource efficiency, considering its current size (which is too large, as shown ahead), is likely to require, on the basis of its benchmarks best practices, the dramatic increase of its labour inspec-

tors productivity, namely regarding the production level of the outputs O5 (+887%), O6 (+574%), O11 (+237%), O8 (+180%), O9 (+141%), O1 (+118%), O3 (+96%) and O13 (+82%), even if at the expense of the production level of the outputs O10 (-94%) and O12 (-90%), as shown in Table 18.

Description		Benchmark outputs		Actual output levels	Beja local branch outputs		
		Caldas da Rainha	São João da Madeira		Targets to achieve cost efficiency	Outputs improvement level needed	
		($\lambda_j = 1.22167919$)	($\lambda_j = 0.40804087$)			Absolute value	(%)
O1	WRAINQ	11	58	17	37	20	118
O2	SUSPNOT	6	8	8	11	3	32
O3	FINCOL	914	963	772	1,510	738	96
O4	INFRNOT	50	575	264	296	32	12
O5	IMPRNOT	515	515	85	839	754	887
O6	OTHNOT	152	239	42	283	241	574
O8	INSPVIS	579	1,214	430	1,203	773	180
O9	WRKCOVINS	3,934	6,352	3,070	7,398	4,328	141
O10	WRINFSRV	20	0	416	24	-392	-94
O11	PRINFSRV	3,328	5,824	1,911	6,442	4,531	237
O12	PHINFSRV	49	424	2,423	233	-2,190	-90
O13	COVINFAW	5,931	6,829	5,508	10,032	4,524	82

Table 18 – Output targets estimation for the Beja local branch to become resource efficient

Source: Own elaboration, based on ACT data and EMS outputs

5.4.1.5 Scale resource efficiency

The results of this research topic also highlight (as shown in Table 16 and Appendices 12.1 and 12.2), that in spite of existing 21 pure technically resource efficient ACT local branches (Aveiro, Barreiro, Bragança, Caldas da Rainha, Castelo Branco, Covilhã, Évora, Figueira da Foz, Guimarães, Lamego, Leiria, Portalegre, Porto, São João da Madeira, Setúbal, Sintra, Tomar, Viana do Castelo, Vila Franca de Xira, Vila Real and Viseu), only 14 of these are technically resource efficient (Aveiro, Barreiro, Caldas da Rainha, Covilhã, Évora, Leiria, Porto, São João da Madeira, Setúbal, Sintra, Viana do Castelo, Vila Franca de Xira, Vila Real and Viseu), meaning that the latter are also scale efficient. Indeed, Table 16 shows that the ACT local branches of Bragança, Castelo Branco, Figueira da Foz, Guimarães, Lamego, Portalegre and Tomar, despite being managed and organized in a resource efficient way (i.e., with PTE = 100%) when compared to local branches with similar size, they are not scale efficiency (i.e., SE < 100%), having therefore scope for improvement of its scale resource efficiency and consequently, to improve its technical resource efficiency. The results suggest, moreover, on the basis of the sum of the inefficient local branches λ_j scale multipliers shown on Table 16, that while the local branch of Guimarães is too large, presenting DRS, the ACT local branches of Lamego, Figueira da Foz, Portalegre, Bragança, Tomar and Castelo Branco are too small, showing IRS. As such, the ACT local branch of Guimarães would benefit,

in terms of scale resource efficiency, if it was smaller, while the latter would benefit if their sizes, in terms of resources allocation, were bigger. Table 16 also points out the existence of 11 ACT local branches that are neither pure technically resource efficient nor scale resource efficient (Almada, Beja, Braga, Coimbra, Faro, Guarda, Lisboa, Penafiel, Portimão, Santarém and Torres Vedras). Therefore, for these latter branches to become technically resource efficient they have to improve not only their pure technical resource efficiency, but also their scale resource efficiency. In particular, the results indicate that the ACT local branches which are apparently too large and present DRS (Lisboa, Braga, Beja, Coimbra, Faro, Almada and Santarém), should improve their technical resource efficiency through both the improvement of their pure technical resource efficiency and the reduction of their size, namely through their splitting. However, in the specific case of the ACT local branches of Penafiel, Santarém and Guarda, their efforts to improve their technical resource efficiency should be essentially focused on the improvement of their pure technical resource efficiency, since their scale efficiency is very close to the 100%. As for the ACT local branches whose size appears to be too small, showing IRS (Portimão, Torres Vedras and Penafiel), the results suggest that their technical resource efficiency might be improved either through the development of their pure technical resource efficiency, through the increase of their size (namely through its merger with other smaller, yet adjacent, branches), or both. Moreover, when comparing the ACT local branches according to their size, the research results also show that the ACT local branches whose pure technical resource efficiency best practices are learning benchmarks for a larger number of relative resource inefficient ones, being therefore considered the most robust, are Barreiro, São João da Madeira and Vila Franca de Xira (each one of these acting as learning benchmark for 7 pure technically resource inefficient branches). In fact, and with the exception of the Lisbon branch (which might learn with the ACT Porto branch), all the other pure technically resource inefficient branches have either Barreiro, São João da Madeira or Vila Franca de Xira, or the three, as learning benchmarks (see Table 16). It is worth remembering, that the results have also showed that the ACT local branches of Barreiro, São João da Madeira and Vila Franca de Xira were also the most robust technically resource efficient learning benchmarks.

5.4.1.6 Resource efficiency drivers

Regarding the resource efficiency drivers, the results of the exploratory analysis conducted (cf. Appendix 13) indicate that the local branches technical resource efficiency is, *ceteris paribus*, as higher as the average number of training hours of the staff ($r = 0.36$; $p = 0.0416$). This result, moreover, is similar to the effect of this same variable on the technical cost efficiency, although showing, in this case, a weaker positive correlation and individual significance level. This positive correlation seems also in line with the fact that the staff of the technically resource efficient branches benefit from an average number of training hours which is about 86% higher than the one of the staff of the technically resource inefficient branches. This finding is also consistent with the relevance commonly acknowledged to training on the literature, as discussed earlier. Moreover, this research results also suggest that the ACT local branches technical resource efficiency is, *ceteris paribus*, as lower as higher is the size of the local branch jurisdiction area ($r = -0.36$; $p = 0.0421$), as it also occurs with technical cost efficiency, but, again, with a weaker negative correlation and individual significance level. This negative correlation seems to be supported by the fact that the jurisdiction area size of the technically resource efficient local branches is, on average, about 37% lower than the one of the technically resource inefficient local branches and 25% lower than the average jurisdiction area size of the ACT local branches. This result is also consistent with the coefficient of -0.0054 associated to the independent variable 'size of the jurisdiction area in square kilometers' ($p\text{-value} = 0.01$) in its estimated linear regression equation with the dependent variable 'number of inspection visits'. In addition, this result appears also in line with the assumption, already discussed, according to which the higher the jurisdiction area size the higher are likely to be the resources needed and the lower are likely to be the level of the outputs produced. Indeed, and taking the ACT local branch of Beja as an example, one realizes that the fact that Beja being the relatively worse ACT local branch in terms of technical resource efficiency (TE = 56.9%, as shown in Table 16) might be mainly attributable to its huge jurisdiction area size, which is the largest of the ACT (about 561% larger than the average size of the technically resource efficient branches and around 397% larger than the average jurisdiction area size of all the ACT local branches). In fact, this jurisdiction area size seems to induce a higher level of resources consumption than the level required by the technically resource efficient local branches, such as technical officials (more 24%) and service cars

(more 45%). Moreover, its jurisdiction area size also appears to encourage a relatively lower level of outputs provision, when compared with the average level of outputs produced by the technically resource efficient local branches. This is particularly true regarding the lower number of inspection visits carried out (about -72%) and, as a consequence, regarding the number of workers covered by the inspection visits (-79%), the number of work-related accidents inquiries performed (-29%), the number of suspension notices issued (-30%), the number of infraction notices issued (-33%), the number of improvement notices issued (-84%) and, in general, regarding the level of the outputs that require traveling.

5.4.1.7 Resource efficiency versus cost efficiency

It is also interesting to analyze simultaneously the various ACT local branches, regarding their technical resource efficiency scores and technical cost efficiency scores in relation to their respective mean, as illustrated in the following Figure 11 scatter plot.

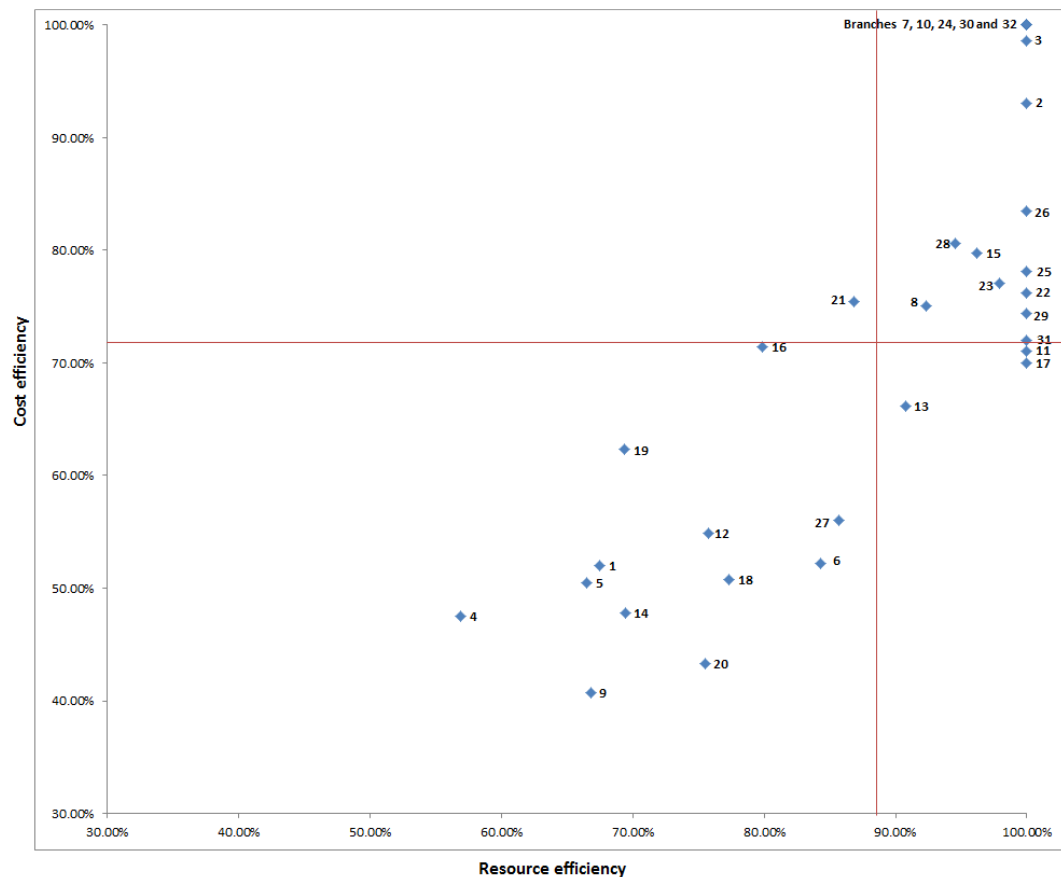


Figure 11 - ACT local branches relative technical cost efficiency and relative technical resource efficiency

Source: Own elaboration, based on EMS outputs exhibited as Appendices 12.1 and 12.3.

Note: The red lines represent the mean of the technical cost efficiency scores (horizontal red line) and of the technical resource efficiency scores (vertical red line)

Besides a strong positive correlation between the technical cost efficiency scores and the technical resource efficiency scores, as it would be expected (with $r = 0.83$, as can be seen in Appendix 13), it is also possible to identify four different sets of ACT local branches.

The first set refers to the branches (represented on the top-right hand side quadrant of the graph) which present above average technical resource and technical cost efficiency scores. In addition to the local branches that are simultaneously technically cost and technically resource efficient (e.g. Caldas da Rainha, Covilhã, São João da Madeira, Vila Franca de Xira and Viseu), it also includes the majority of the remaining technically resource efficient branches (e.g. Aveiro, Barreiro, Porto, Setúbal, Sintra, Viana do Castelo and Vila Real) and some other technically cost and technically resource inefficient branches with above average scores (e.g. Castelo Branco, Guimarães, Santarém and Torres Vedras).

The second set of local branches (included in the bottom-right hand side quadrant of the graph) consists of two technically resource efficient branches with below average technical cost efficiency scores (Évora and Leiria) and a technically resource and technically cost inefficient local branch, with an above average technical resource efficiency score and a below average technical cost efficiency score (Figueira da Foz).

The third set of local branches (represented in the bottom-left hand side quadrant of the graph) integrates the technically cost and technically resource inefficient branches whose technical cost and resource efficiency scores are below average (e.g. Almada, Beja, Braga, Bragança, Coimbra, Faro, Guarda, Lamego, Lisboa, Penafiel, Portalegre and Tomar).

Finally, the fourth set of local branches (located at the top-left hand side quadrant of the graph) includes only the ACT local branch of Portimão, which is a technically cost and technically resource inefficient branch with an above average technical cost efficiency score and a below average technical resource efficiency score.

The analysis of Figure 11 also highlights the fact that the ACT local branches of Aveiro (2), Barreiro (3), Évora (11), Leiria (17), Porto (22), Setúbal (25), Sintra (26), Viana do Castelo (29) and Vila Real (31), even though they are technically efficient in terms of resource consumption, they are not technically efficient in terms of cost.

The analysis of the ACT data suggests that one possible reason may be the fact that these ACT local branches have, on average, a jurisdiction area size which is around 34% wider than the average jurisdiction area size of the local branches which are simul-

taneously technically cost and resource efficient. This assumption, moreover, is consistent with the fact that none of those branches is scale cost efficient (i.e., their SE scores are all below 100%, as shown in Table 16). However, when comparing the technical cost efficiency with the pure technical cost efficiency of those branches, one realizes that while Aveiro, Barreiro, Porto and Sintra are being managed in a properly cost efficient way, in spite of not being scale cost efficient (showing, therefore, PTE scores of 100%), the same is not happening with the remaining, which are also pure technical cost inefficient. Therefore, an additional explanation appears to be the fact that these branches consume, on average, a higher level of the most expensive resources (labour inspectors and technical officials). The latter, incidentally, is consistent with the fact that these ACT local branches use, in fact, and on average, around more 61% of labour inspectors, 96% of technical officials and 78% of technical assistants than the local branches which are simultaneously technically cost and resource efficient. Moreover, these ACT local branches use premises with areas which are, on average, around 103% greater than those of the local branches which are simultaneously technically cost and resource efficient, for which they pay rents which are, on average, 129% higher. Consequently, these local branches support, on average, more €370 thousand of operational costs (corresponding to an average increase of about 87% on costs) than the local branches which are simultaneously cost and resource efficient, thus presenting, on average, an higher average cost per unit of output.

5.4.2 Effectiveness

5.4.2.1 ACT local branches effectiveness

Regarding the ACT local branches relative effectiveness, the research results indicate, as shown in Table 16 and Appendix 12.6, that there are only four (around 13% of the total) effective ACT local branches (Castelo Branco, Covilhã, Sintra and Torres Verdas). The results also allow seeing that the ACT overall effectiveness in preventing fatal and non-fatal work-related accidents and days of absence from work is around 83%, with a standard deviation of about 14% and 38% of the local branches showing effectiveness scores below average. Besides suggesting the existence of a wide scope for effectiveness improvement, these findings also highlight the considerable variability of the local branches effectiveness, thus emphasizing the relevance of sharing the

best practices between the learning benchmarks and the ineffective local branches. Concerning the effectiveness learning benchmarks, the results indicate that the most robust are Castelo Branco (serving as learning benchmark for 14 local branches) and Torres Vedras (which have 12 local branches looking up to it). Except for Barreiro and Bragança local branches (which might learn from Sintra local branch best practices), the remaining ineffective local branches have either Castelo Branco or Torres Vedras branches, or both, as learning benchmarks (see Table 16). Furthermore, when comparing the ACT local branches effectiveness scores with both the technical cost efficiency scores and the technical resource efficiency scores, one realizes that only Covilhã branch is simultaneously technically cost efficient, technically resource efficient and effective. In fact, Torres Vedras is neither technically cost efficient nor technically resource efficient, whereas Castelo Branco has only pure technical resource efficiency. Sintra, on the other hand, in spite of being pure technically cost efficient and enjoying technical resource efficiency, is not scale cost efficient, as already discussed.

Moreover, comparing the production patterns of two ineffective local branches with different strategic priorities and production patterns (e.g., the Lisbon and the Caldas da Rainha branches) with their respective benchmarks (the Torres Vedras and the Castelo Branco branches, respectively), based on their outcome levels, as depicted in Figure 12, allows a better understanding of their production priorities and effectiveness mechanisms, enabling the identification of possible learning paths for their effectiveness improvement.

Figure 12 compares the outcome levels of the Lisbon ineffective branch (before the DEA non-negativity adjustment protocol mentioned earlier, exhibited in Appendix 11.9) with the Torres Vedras branch which, besides being the benchmark of the Lisbon branch, is also a learning benchmark for another 11 local branches (see Table 16). It also compares the outcome levels (before the DEA non-negativity adjustment protocol) of the Caldas da Rainha branch (which is one of the most ineffective branches, with an effectiveness score of 61.32%) with the ones of the Castelo Branco branch which, besides being the benchmark of the Caldas da Rainha branch, is also a learning benchmark for another 13 local branches (cf. Table 16 and Appendix 11.9).

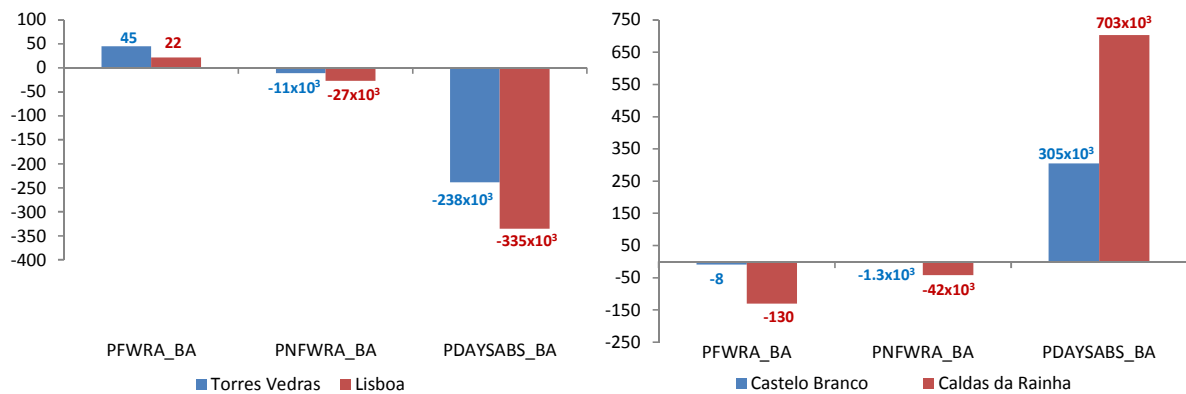


Figure 12 - Comparing the outcome levels (before non-negativity adjustments) of the Lisbon and Caldas da Rainha ineffective branches with their benchmarks

Source: Own elaboration, based on the Appendices 11.1 to 11.7 and 11.9 data, as well as on GEP (2015), INE (2013) and Eurostat (2016).

Notes: PFWRA_BA - Number of prevented (or allowed) fatal work-related accidents per 100,000 workers before non-negativity adjustment; PNFWRA_BA - Number of prevented (or allowed) non-fatal work-related accidents per 100,000 workers before non-negativity adjustment; PDAYSABS_BA - Number of prevented (or allowed) days of absence from work per 100,000 workers.

Looking at Figure 12 one realizes, as it would be expected, considering the imposed weight restrictions, that both the Torres Vedras and the Lisbon branches are focused on preventing fatal and non-fatal work-related accidents, as well as on minimizing the number of days of absence induced by the latter. Their different performance levels seem to reside, therefore, on the extent to which they actually prevent the occurrence of such events. As can be seen in Figure 12, the Torres Vedras and the Lisbon branches just managed to prevent the occurrence of fatal accidents at work, in relation to the Eurostat (2016) ESAW benchmark. The Torres Vedras branch prevented 45 fatal work-related accidents per 100,000 workers while the Lisbon branch prevented around half of that (22 fatal-work-related accidents per 100,000 workers). None of them, however, managed to prevent non-fatal work-related accidents or days of absence from work in relation to the respective ESAW benchmark. In fact, both local branches ‘allowed’ (or failed to prevent) the occurrence of an excess of non-fatal work-related accidents and days of absence, per 100,000 workers, when compared to their expected occurrences, if the respective ESAW benchmark were applied. Notwithstanding the above, the Torres Vedras branch managed to ‘allow’ the occurrence of a 59% lower excess on the number of non-fatal work-related accidents in relation to the European ESAW benchmark (about 11 thousand per 100,000 workers) and a 29% lower excess on the number of days of absence from work (around 238 thousand per 100,000 workers) than the Lisbon ineffective branch (which ‘allowed’ the occurrence of an excess of about 27 thousand of non-fatal work-related accidents per 100,000 workers and around and excess of 335 thousand of days of absence from work per 100,000 workers).

The analysis of Figure 12 also allows seeing that the ACT local branches of Castelo Branco and Caldas da Rainha just managed to prevent days of absence, in relation to the European benchmarks, having failed, however, to prevent the occurrence of both fatal and non-fatal work-related accidents. Indeed, and looking at these ACT local branches' data, regarding their outcome levels before the DEA non-negativity adjustment protocol (see Appendix 11.9), it can be seen that the Caldas da Rainha branch managed to prevent about 703,221 days of absence from work per 100,000 workers, while its benchmark 'only' prevented less than half of that (304,873 days per 100,000 workers). Notwithstanding the aforesaid, and regarding the occurrence of fatal and non-fatal work-related accidents, while Caldas da Rainha branch presents an excess (in relation to the EU 28 benchmark) of about 130 fatal work-related accidents per 100,000 workers (meaning that it failed to prevent, or it allowed, the occurrence of about 130 fatal accidents at work per 100,000 workers) and of around 41,770 non-fatal work-related accidents per 100,000 workers, Castelo Branco branch proved to be substantially more effective, presenting an excess in relation to the EU 28 benchmark of 'just' around 8 fatal work-related accidents per 100,000 workers and of about 1,292 non-fatal work-related accidents per 100,000 workers. A closer look into these latter local branches data, in order to better understand their different effectiveness levels, allows seeing that, despite having a jurisdiction area about 79% smaller than the one of the Castelo Branco branch, the Caldas da Rainha branch serves a volume of population employed around 79% larger than the one served by the Castelo Branco branch. In particular, the Caldas da Rainha branch employs a much higher volume of population in the economic activity sectors that expose workers to higher levels of occupational risks and which have, typically, higher incidence rates of accidents at work. The latter include economic activity sectors such as agriculture, forestry and fishing (+150% of employed population than on the Castelo Branco branch jurisdiction area), mining and quarrying (+1,140%), manufacturing (+107%), construction (+52%), wholesale and retail trade (+128%) and administrative and support service activities (+75%). As such, the Caldas da Rainha branch jurisdiction area presents incidence rates of fatal work-related accidents per 100,000 workers which are considerable higher than the ones showed by the Castelo Branco jurisdiction area, particularly in the agriculture, forestry and fishing sector and in the transportation and storage sector. The same applies to the non-fatal work-related accidents incidence rates per 100,000 workers in the generality of economic activity sectors, except for the water supply, sewerage, waste management and remediation activities sector and for the

other service activities sector. As for the average days of absence from work per 100,000 workers, the Caldas da Rainha branch jurisdiction area only shows a lesser average than the Castelo Branco jurisdiction area in relation to economic activity sectors such as manufacturing, wholesale and retail trade, information and communication activities, and public administration, defence and compulsory social security. Not surprisingly, Caldas da Rainha branch jurisdiction area presents, in 2013, numbers for fatal work-related accidents, non-fatal work-related accidents and average days of absence from work which are, respectively, 6 times, 3.9 times and 3.6 times higher than the ones presented by the Castelo Branco jurisdiction area. Moreover, and in spite of having a 79% larger volume of employed population to serve than the Castelo Branco branch, the Caldas da Rainha branch accounts for about 11% less labour inspectors than the Castelo Branco branch, thus presenting an average number of workers to be served per labour inspector which is 34% higher than the one recommended by the ILO and the double of the one presented by the Castelo Branco branch. Furthermore, in addition to a 55% lower average number of training hours per staff member (-67% in the specific case of the labour inspectors) than the ones shown by the Castelo Branco branch, the Caldas da Rainha branch only benefits from around 33% of its director's time (which is about 67% less than the time that the Castelo Branco branch benefits from its own director), as the director of the Caldas da Rainha branch also manages the Torres Vedras branch (to which he allocates the remaining 67% of his time). It is also worth noting that, when compared to its benchmark, the Caldas da Rainha branch also presents a much lower number of inspection visits carried out (a total of -19% inspection visits, of which: -47% of follow-up visits, -36% of simultaneously labour relation and OSH visits, and -21% of inspected workplaces) and a lower number of other notices issued (a total of -63%, of which, -70% warning notices issued).

5.4.2.2 Effectiveness drivers

Concerning the effectiveness drivers, the results of the exploratory analysis carried out (cf. Appendices 8 to 11.9 and 13) suggest, as it would be expected, that the variable most strongly and positively correlated with the ACT local branches effectiveness scores is the number of prevented fatal work-related accidents per 100,000 workers ($r = 0.8$; $p = 0.0000$) and, in a much lower degree, the number of prevented non-fatal work-related accidents per 100,000 workers ($r = 0.37$; $p = 0.0362$). These results predictabil-

ity stems not only from the fact that these variables, along with the number of prevented days of absence from work, were the only three outcome indicators included in the effectiveness DEA model, as well as from their imposed weight restrictions, but also from its consistency with the anticipated negative correlation between the total number of fatal work-related accidents occurring in the ACT local branches jurisdiction areas and their effectiveness scores ($r = -0.5$; $p = 0.0035$). Especially regarding the fatal work-related accidents occurred in the agriculture, forestry and fishing sector ($r = -0.37$; $p = 0.0352$), in the mining and quarrying sector ($r = -0.39$; $p = 0.0286$) and in the transportation and storage sector ($r = -0.35$; $p = 0.0492$). It is interesting to note, though, that among the fatal work-related accidents, the ones whose prevention is more likely to improve the local branches effectiveness scores are, *ceteris paribus*, the ones prevented in the economic activity sectors of mining and quarrying ($r = 0.4$; $p = 0.0224$) and transportation and storage sector ($r = 0.38$; $p = 0.0339$). These findings are consistent, moreover, with the observed negative correlation between the local branches effectiveness scores and their jurisdiction areas incidence rates of fatal work-related accidents in the mining and quarrying sector ($r = -0.4$; $p = 0.0224$) and in the transportation and storage sector ($r = -0.38$; $p = 0.0339$). They also seem in line with the negative correlation between the ACT local branches effectiveness scores and the total number of fatal work-related accidents occurred in 2013 in their jurisdiction areas economic activity sectors of mining and quarrying ($r = -0.39$; $p = 0.0286$) and transportation and storage ($r = -0.35$; $p = 0.0492$). Moreover, among the non-fatal work-related accidents, the ones whose prevention is more likely to improve the local branches effectiveness scores are, *ceteris paribus*, the ones prevented in the economic activity sectors of mining and quarrying ($r = 0.36$; $p = 0.0431$) and manufacturing ($r = 0.36$; $p = 0.0445$), which is no surprise, considering the negative correlation between the local branches effectiveness scores and their jurisdiction areas incidence rates of non-fatal work-related accidents in the mining and quarrying sector ($r = -0.36$; $p = 0.0431$) and in the manufacturing sector ($r = -0.36$; $p = 0.0445$). In addition, the prevented days of absence from work more likely to improve the local branches effectiveness scores are, *ceteris paribus*, the ones prevented in the electricity, gas, steam and air conditioning supply sector ($r = 0.46$; $p = 0.0083$). This finding, moreover, is in line with the negative correlation between the ACT local branches effectiveness scores and both their jurisdiction areas total number of absence days in the electricity, gas, steam and air conditioning supply sector ($r = -0.38$; $p = 0.0308$) and average number of days of absence from work per 100,000 work-

ers in the electricity, gas, steam and air conditioning supply sector ($r = -0.4$; $p = 0.0235$). The results also suggest that the effective local branches, besides serving, on average, a 4% lower volume of employed population (having, therefore, a lower volume of workers exposed to occupational risks) than the ineffective branches employ, on average, in their areas of jurisdiction, a lower volume of workers in the economic activity sectors that usually expose workers to higher levels of occupational risks and which typically present higher incidence rates of accidents at work, as can be seen in the Eurostat (2016) ESAW online database. The latter, moreover, seems consistent with the finding that the main economic activity sector of a given establishment has statistically significant explanatory power for the total number of work-related accidents registered in that establishment, as shown by the results of the research on the explanatory factors for the (in)effectiveness of the PMOSHMS in preventing work-related accidents. Indeed, the volume of employed population in the economic activity sectors with higher work-related accidents incidence rates of the effective local branches' jurisdiction areas is much lower than the one employed in such sectors of the ineffective branches' jurisdiction areas, as follows: agriculture, forestry and fishing (this sector employs less 39% of the workers in the effective local branches' jurisdiction area than on the ineffective local branches' jurisdiction area), mining and quarrying (this sector employs less 57% workers in the effective local branches' jurisdiction area), manufacturing (-40% workers employed in the effective local branches' jurisdiction area), construction (-21% workers employed) and wholesale and retail trade (-1%). These findings, moreover, seem consistent with the evidenced negative correlation between the local branches effectiveness scores and their jurisdiction areas incidence rates of fatal ($r = -0.4$; $p = 0.0224$) and non-fatal ($r = -0.36$; $p = 0.0431$) work-related accidents in the mining and quarrying sector, as well as with their average number of days of absence from work per 100,000 workers in the agriculture, forestry and fishing sector ($r = -0.36$; $p = 0.0409$). As a result, the effective local branches jurisdiction areas appear to show, on average, a lower fatal work-related accidents incidence rates in the economic activity sectors which traditionally have higher national fatal work-related accidents incidence rates, such as: agriculture, forestry and fishing (-44%); mining and quarrying, manufacturing and administrative and support service activities sector (all with -100%); construction (-89%); and transportation and storage (-85%). Furthermore, they also present, on average, a lower non-fatal work-related accidents incidence rates in the economic activity sectors that usually have higher non-fatal work-related accidents incidence rates at national level,

such as agriculture, forestry and fishing (-33%), mining and quarrying (-63%), manufacturing (-32%), construction (-31%), wholesale and retail trade sector (-19%), transportation and storage (-14%), and administrative and support service activities sector (-44%). The results also indicate that the effective local branches show, on average, a lower number of days of absence from work due to non-fatal work-related accidents in several economic activity sectors with higher work-related accidents incidence rates at national level, such as agriculture, forestry and fishing (-25%), mining and quarrying (-71%) and manufacturing (-3%). These findings, moreover, seem consistent with the fact that the effective local branches jurisdiction areas, when compared with the ineffective ones, account for less work-related accidents and days of absence from work (-72% fatal work-related accidents, -43% of non-fatal work-related accidents and -32% of days of absence from work). This research results also reveal that the effective local branches have, on average, a jurisdiction area size that is about 26% lower than the jurisdiction area size of the ineffective branches. This finding, on the other hand, seems consistent with the observed negative correlation between the ACT local branches effectiveness scores and the average annual cost with the labour inspectors daily allowances ($r = -0.4$; $p = 0.0221$) which, incidentally, appears to act as a proxy for its jurisdiction area size. In fact, the daily allowances are only due in cases of service travels which implies covering a distance over 20 kilometers from the periphery of the locality where the local branch headquarters are located and since the travels covers the period between 13 and 14 hours, between 20 and 21 hours or if it involves accommodation, when the worker does not have regular public transport to return to his residence until 22 hours (Portuguese Government, 1998). Moreover, the higher the amount of allowances paid to the labour inspectors, the longer and the more time-consuming are likely to be their service travels. In this context, it seems reasonable to assume that the higher the allowances paid to the labour inspectors the lower is the expected time they spend on carrying out inspection visits and applying inspection procedures and, therefore, the lower is expected to be their outputs and, consequently, their outcomes, as it also occurs regarding the size of the local branches jurisdiction area, as discussed earlier. The results also allow seeing that the labour inspectors of the effective branches serve, on average, a number of workers which is 8% lower than the ineffective ones and 7% lower than the average number of workers served by the overall ACT local branches. Furthermore, the results also indicate that the effective local branches, when compared with the ineffective ones, consume, on average, a much lower level of the different resources (e.g. about

-17% of labour inspectors, -54% of technical officials, -59% of technical assistants, -60% of operational assistants and -15% of service cars) thus supporting, on average, around -37% of operational costs than the ineffective branches. The latter, moreover, is consistent with the finding that the effective branches present an average seniority of the staff which is 23% lower than the one of the ineffective branches, which might also contribute to the effective branches lower operational costs, as discussed earlier. The fact that the effective branches present a lower seniority level than the ineffective ones seems also to suggest, on the other hand, that the higher the seniority level of the staff of a local branch, the lower is expected to be its effectiveness. In spite of its apparent consistency with the proposed decline in average productivity contributions of old workers (V. Skirbekk, 2004) and, to some extent, with the large variance in age-productivity profiles between establishments, found by Göbel & Zwick (2009, 2013) and Lallemand & Rycx (2009), this assumption appears to contradict Quiñones, Ford, & Teachout (1995) findings, according to which the relationship between work experience and job performance, regardless of the work experience measure used, is positive, whereas the strongest relationship occurs between the amount of experience and performance. Moreover, and besides its inconsistency with the thesis that work experience is critical in learning and developing the knowledge, skills, and abilities necessary for effective performance (Morrison & Brantner, 1992), it also contradicts Schmidt, Hunter, & Outerbridge (1986), which found that job tenure has a strong effect on performance, through the development of job knowledge and skills. This assumption also contradicts a number of studies that found significant and positive relationships between job tenure and job performance, through increased job knowledge and competencies (Borman, Hanson, Oppler, Pulakos, & White, 1993; Schmidt et al., 1986; Vance, Coover, MacCallum, & Hedge, 1989), as well as with several others which argue that higher shares of old employees do not necessarily imply a decrease in productivity (Aubert & Crépon, 2006; Malmberg, Lindh, & Halvarsson, 2008). In this context, the observed relation between the local branches lower average seniority and their higher effectiveness scores seems to indicate the existence of an eventual mismatch between the age of the ACT local branches officials and the nature of their tasks and working conditions, and the possible need, as stressed by Ilmarinen (2006) in a broader context, for a better adjustment of work due to the effect of ageing on the deterioration of health, namely through a change in work requirements, the design of age-specific jobs for old workers or applying mixed-age working teams, as suggested by Göbel & Zwick (2013). Which

looks consistent, moreover, with the high level of physical and mental demands of the jobs performed by the ACT local branches staff (particularly in the cases of the labour inspectors and the technical officials), especially regarding its high complexity and demands in terms of knowledge and skills, as well as with the 14 years average seniority of the ACT local branches staff, considering the moderating role of the length of experience and of the job complexity on the relation between job experience and job performance noted by Mcdaniel, Hunter, & Schmidt (1988). This assumption also appears in line with the growing concerns about the ageing of the European and national workforce (European Commission, 2012; Eurostat, 2017; INE, 2012) and the consequent need for adapting the working conditions to an increasingly older workforce (EU-OSHA, 2016b; Ramos, 2017). These concerns, moreover, were identified as one of the main challenges in the Strategic Framework on Health and Safety at Work 2014-2020 (European Commission, 2014) and justified the launch, by the EU-OSHA, of the European Campaign 'Healthy Workplaces for All Ages 2016-2017' (EU-OSHA, 2016a). Especially taking into account that, as we become older, physical capacities decrease, cognitive functioning changes and relevant individual skills and abilities of older employees decline (Vegard Skirbekk, 2008), with chronic symptoms and diseases often impairing the ability to work, whereas musculoskeletal and psychosocial disorders are the most prevalent cause of work disability among older workers and the incidence of occupational diseases becomes linear with age (Ilmarinen, 2006). The results also suggest that the local branches effectiveness might be explained by other factors. One of those seems to be the amount of time that the local branches' managers allocate to their management. This assumption, moreover, is supported by the verification that the effective local branches use, on average, more 6% of their local branch director's time than the ineffective ones. Other possible explanation might be the fact that the effective local branches provide their staff with a higher average number of training hours than the ineffective ones. Indeed, and looking at the local branches data, one realizes that the effective local branches provide their staff with an average number of training hours which is about 125% higher than the one provided by the ineffective branches, especially in the cases of the technical officials (+143%) and the labour inspectors (+79%). This finding, moreover, is consistent with the statistically significant positive impact of staff training on service performance (MacKelprang et al., 2012) and job performance (Lin & Hsu, 2017) and, in particular, with the understanding that the training of the labour inspectors is crucial to an effective and efficient labour inspection (ILO, 2006c) or is viewed as the

most relevant tool to improve the labour inspectors performance (Richthofen, 2002). It also finds support on the relevance commonly recognized to training in the literature, as discussed earlier. In addition, the local branches effectiveness might also be explained by the fact that the staff of the effective local branches presents a higher number of years of completed education than the staff of the ineffective ones. In fact, the research results indicate that the effective local branches staff shows, on average, a number of years of completed education which is about 7% higher than the one presented by the ineffective branches. This finding, moreover, appears to be in line with the observed positive correlation between the local branches effectiveness scores and the average number of years of completed education of the labour inspectors ($r = 0.38$; $p = 0.0305$). The suggested relevance of the level of education of the local branches staff (especially of the labour inspectors) in their effectiveness, on the other hand, seems also consistent with the aforesaid importance of training, since the differences between the education levels of the labour inspectors across the ACT local branches may easily be assimilated as vocational training. Indeed, and considering that the labour inspectors are required to have a university academic degree, their different level of education is mainly attributable to master degrees and post-graduated courses on OSH and labour law subjects which, integrating the ACT areas of legal competencies, are precisely the ones more likely to grant them the benefits from the status of worker-student or scholarship. As for the output levels of the activities performed, the results indicate that the effective branches, when compared to the ineffective ones, present, on average, a relatively lower level of production outputs regarding the generality of the local branches activities, with the exception of the number of inspection visits carried out. In particular, the effective branches present, on average, a lower number of fines collected (-62%), suspension notices issued (-26%), workers covered by the inspection visits (-41%), people covered by the information actions and awareness raising campaigns (-50%) and a lower number of persons covered by the local written, face-to-face and phone information and advise services (respectively, -89%, -38% and -50%). The results also allow seeing that the effective local branches also show, on average, a 45% lower number of work-related accidents inquiries than the ineffective ones which, in turn, might be explained by the fact that the effective local branches jurisdiction areas present, on average, when compared to the the ineffective branches jurisdiction areas, -72% fatal work-related accidents and -43% non-fatal work-related accidents. The effective local branches, however, tend to excel the ineffective ones in relation to several labour inspection activities out-

puts, such as the number of improvement notices issued (+12%), the number of inspection visits carried out (+22%) and the number of other notices issued (+61%), especially in the case of notifications to other competent authorities (+26%) and warning notices (+120%) which, moreover, seems consistent with the observed positive correlation between the effectiveness scores of de ACT local branches and the number of warning notices they issue ($r = 0.35$; $p = 0.0473$). Regarding the inspection visits, however, it is worth noting that, when compared to the ineffective branches, the effective ones carry out, on average, more 62% of follow-up visits, more 7% of first visits, more 13% of exclusively labour relation visits, more 1% of exclusively OSH visits and more 36% of simultaneously labour relation and OSH visits. In addition, the labour inspectors of the effective local branches visit, on average, more 4% of employers and more 18% of workplaces than the ones of the ineffective local branches. Moreover, and in spite of the effective local branches perform a higher number of inspections visits and cover a larger number of employers and of workplaces than the ineffective ones, the effective local branches present a 41% lower number of workers covered by the inspection visits carried out. This result suggests that the effective local branches tend to focus their inspection activity on the smaller employers, namely on the micro enterprises and SMEs. As such, this result appears to indicate that the effective local branches seem to be more successful than the ineffective ones in helping micro enterprises and SMEs to overcome their recognized (Enrico Cagno et al., 2013; European Parliament, 2014; Hasle, Kvorning, et al., 2012) difficulties in complying with the labour and OSH regulations and in ensuring decent and safe working conditions. It is important to note, however, that this finding does not necessary mean that the effective local branches effectiveness is a result of their efforts on the OSH improvement of, specifically, smaller workplaces. Indeed, and conversely, it can also mean that their effectiveness is a mere consequence of the fact that their areas of jurisdiction are mainly populated by micro enterprises and SMEs which, as seen in the researches on the preceding topics, have a lower propensity for the occurrence of work-related accidents, to the extent that, among other factors, they have typically a lower number of workers exposed to occupational risks. In fact, and considering that the relative effectiveness of an ACT local branch is, *ceteris paribus*, as higher as the number of work-related accidents prevented in its area of jurisdiction, the latter assumption finds support on the results of the preceding research on the predictors of fatal work-related accidents, which found a statistically significant positive correlation between the size of the employer and their workers probability of being vic-

tims of a fatal work-related accident. That latter assumption, moreover, also appears in line with the results of the previous research on the critical factors for the (in)effectiveness of the PMOSHMS in preventing work-related accidents, which found that the larger is a given establishment (in terms of the average number of persons working there, including employees, subcontractor's workers, temporary workers and self-employed workers), the more likely is the occurrence of a work-related accident. Furthermore, the research findings also suggest that the effective ACT local branches appear to be more focused on a closer approach to the workplaces, mainly through the performance of more follow-up visits than first visits and giving priority to wider scope inspection visits (which include both labour relations and OSH issues). They also indicate that the effective local branches tend to privilege essentially the application of information, advice and executory inspection procedures (e.g. improvement notices and warnings) which, despite their binding and mandatory nature, are not sancionatory (as it would happen, for example, with the infraction notices and infringement proceedings), more in line with what the employers consider more appropriate and effective, as observed Niskanen et al. (2014). Overall, these results seem to suggest that the inspection gesture of the ACT effective local branches is somehow more pedagogical and educational in nature than the one put forward by the ineffective branches.

5.5 Concluding remarks

The research study, on this particular subject, had two main purposes: to assess the ACT's performance in preventing work-related accidents, pinpointing eventual performance gaps and identifying possible paths to improve its efficiency and effectiveness; and to put forward the DEA methodology as a suitable quantitative technique for assessing the performance of labour inspectorates on the basis of multiple input, output and outcome indicators, complementing the results of other more commonly used evaluation methodologies and answering to the call of both the IALI and the ILO.

As for the first goal, the research results allow to draw up some important conclusions on the ACT's performance, both in terms of its efficiency and effectiveness. In particular, the results found that the ACT shows a considerable scope for both efficiency and effectiveness improvement. Indeed, the overall ACT technical cost efficiency and technical resource efficiency scores were at about 72% and 88.6%, respectively, with only 5 out of 32 ACT local branches proving to be technically cost efficient (about

16% of the total) and 14 showing an efficient use of their resources (around 44%), whereas 15 presented technical cost efficiency scores below average (about 47%) and 13 have shown technical resource efficiency scores below average (almost 41% of the total). Regarding the effectiveness assessment, the results allow us to conclude that the overall ACT effectiveness score was at about 82.5%, with only 4 ACT local branches proving to be relative effective (about 13% of the total) and 12 presenting effectiveness scores below average (around 38%).

This research findings also suggest that the ACT local branches efficiency and effectiveness and, therefore, the overall ACT performance in preventing work-related accidents, is influenced, in some extent, by the impact of several exogenous contextual factors, over which both the ACT local branches directors and the ACT directorate have limited or no control. These include, in particular, the size of the ACT local branches areas of jurisdiction, the volume of the employed population by each local branch jurisdiction area and, most especially, the distribution of the employed population across the economic activity sectors of their local branches areas of jurisdiction. Considering the lack of output prices and exit decisions to sanction inefficient units in the public sector, as noted Peyrache & Zago (2016), the negative effect of the aforementioned exogenous contextual factors in the ACT performance, poses important challenges. Especially in what concerns finding and implementing, for each ACT local branch, the optimal area of jurisdiction, taking into account its size and a more adequate employed population distribution by their different economic activity sectors, considering its volume and the different risk level associated to each sector. Moreover, the research findings allow us to conclude that, besides the aforementioned exogenous factors, the local branches efficiency and effectiveness are also influenced by other variables, essentially endogenous in nature, over which the local branches managers and the ACT directorate have some control. These variables include the staff characteristics (e.g. average number of training hours, level of education and seniority), the time allocated by the local branches directors to their management, the average number of workers served per labour inspector, the inspection activity approach and gesture, and the inspection activity focus, priorities, targets and output levels.

Indeed, and regarding technical cost efficiency, the research findings show that the local branches technical cost efficiency is, *ceteris paribus*, as lower as larger is the size of their areas of jurisdiction, mainly due to its simultaneous impact on both increasing the local branches travelling costs and lowering their output levels. They also lead to the

conclusion that the local branches technical cost efficiency is likely to be, *ceteris paribus*, as worse as higher is their staff average seniority and, consequently, their staff costs, especially in the case of the labour inspectors. The results also support the conclusion that the local branches technical cost efficiency tends to improve, *ceteris paribus*, as the staff average number of training hours increases, especially in the case of the labour inspectors.

As for the technical resource efficiency, the results discussed earlier demonstrate that the local branches technical resource efficiency tends to decline as the size of their jurisdiction areas increases. Conversely, the research findings show that the local branches technical resource efficiency is likely to increase, *ceteris paribus*, as the staff average number of training hours increases, especially in relation to the labour inspectors.

With regard to the ACT local branches relative effectiveness in preventing work-related accidents, this research results allow us to conclude that their relative effectiveness is, *ceteris paribus*, as lower as higher is the volume of the employed population in the economic activity sectors of their areas of jurisdiction that expose the workers to a higher level of occupational risks and which, typically, present higher work-related accidents incidence rates. They also lead to the conclusion that the local branches relative effectiveness is, *ceteris paribus*, as lower as higher is: the size of their areas of jurisdiction, the number of employed population in their areas of jurisdiction and their staff seniority. Conversely, the results indicate that the local branches relative effectiveness is likely to increase, *ceteris paribus*, when the number of workers served per labour inspector drops, as well as when the time allocated by the directors to the management of their ACT local branches increases. The research findings also point out that the local branches effectiveness is expected to be, *ceteris paribus*, as higher as the education level of their staff and as higher as their staff average number of training hours, especially in the case of the labour inspectors. Furthermore, the results show that the local branches relative effectiveness is influenced by the adoption of some distinctive best practices. In fact, the results suggest that, besides consuming, on average, a much lower level of resources than the ineffective branches (supporting, consequently, a much lower level of operational costs), the effective local branches also adopt a different inspection strategic approach. This approach, moreover, is essentially based on the performance of a larger number of inspection visits, mainly targeting micro enterprises and SMEs, as well as on a closer and deeper follow-up and monitoring of a greater number of employers and workplaces, instead of covering a larger number of workers. It privileges the follow-up

visits, rather than first visits, and favors the inspection visits simultaneously aimed at controlling the compliance with the labour relations and OSH standards, to the detriment of the inspection visits exclusively focused either on labour relations or OSH matters. Accordingly, the inspection gesture of the effective local branches appears to be predominantly focused on the application of information, advice and executory inspection procedures (e.g. improvement notices and warnings) which, despite their binding and mandatory nature, are not inherently sancionatory (unlike with infraction notices and infringement proceedings), thus revealing a somehow more pedagogical and educational approach than the one often applied by the ineffective branches.

As for the second purpose of this research, concerning the proposal of the DEA technique to assess the labour inspectorates' efficiency and effectiveness in preventing work-related accidents, the results clearly demonstrate its utility and suitability. This research presents sound evidence regarding the relative efficiency and effectiveness of the ACT local branches. It also points out its major weaknesses and challenges and identifies the learning paths and best practices that could be followed by the poorer performer's branches in order to improve their relative performance. These results, moreover, are expected to induce a deeper internal analysis into the different production processes and performance patterns of the ACT local branches, in order to allow a better insight on its main determinants, the promotion of the best practices sharing, as well as to encourage the expanding of knowledge and the development of the necessary internal competencies, namely through training, to ensure a sustainable performance enhancement. It is therefore expected that this research can make a relevant contribution on the use of DEA in such an under-researched area as the labour inspectorates' performance assessment.

5.6 Main policy implications

In the light of the above conclusions, it seems reasonable to assume that the ACT performance in preventing work-related accidents presents a wide scope for improvement, either in terms of efficiency and effectiveness.

The improvement of the ACT efficiency and effectiveness, however, requires the adoption of several policy measures, some of which located outside the scope of the decision-making powers of both the local branches directors and the ACT directorate. This is clearly the case of the policy measures that require the amendment of the organic

law of the ACT, such as the ones related to the modification of the ACT local branches areas of jurisdiction, or which involve the substantial increase of their resources (e.g. the increase of the ACT budgetary appropriations, the acquisition of service cars, the reinforcement of the staff, in particular through the opening of a public competition for its recruitment). In fact, these measures are either a Portuguese Government exclusive legal competence or its implementation needs its specific authorization, as foreseen in the Organic Law of the XXI constitutional Government (Portuguese Government, 2015b), in the the Budgetary Framework Law (Portuguese Parliament, 2015b), in the Law approving the State budget for 2017 (Portuguese Parliament, 2016) and in the Law establishing the provisions for the implementation of the State budget for 2017 (Portuguese Government, 2017). In this context, the effective adoption of such policy measures depends heavily on the ACT directorate's ability to convince the Portuguese Government and other stakeholders, namely the social partners and the political parties with parliamentary seat, of their relevance and need.

Moreover, and as seen earlier, the ACT local branches relative efficiency in preventing work-related accidents and, consequently, the ACT overall efficiency depends, to a great extent, on the size of their areas of jurisdiction. Therefore, and considering the interest of ensuring a better match between the ACT local branches jurisdiction areas size and the volume and geographic distribution of the employers and of the employed population, one of the main policy measures, which is expected to improve dramatically the local branches efficiency, is the resizing of their areas of jurisdiction as well as the reallocation of their resources. Either through the downsizing of the local branches that feature an excessive size (e.g., Almada, Beja, Braga, Coimbra, Faro, Guimarães and Lisbon) to reinforce those featuring a size too small (e.g. Bragança, Castelo Branco, Figueira da Foz, Lamego and Portimão), through the splitting of the local branches which are too large or through the merger of local branches which are too small. Such resizing and resources reallocation, besides allowing a more rational distribution of the resources across the local branches and promoting a more rational and synergic use of the available resources, especially of the human resources, is also expected to enable the reduction of the time and costs invested in service travels as well as to avoid the latter to undermine the local branches output and outcome levels. In addition, the aforementioned conclusions also suggest that the ACT efficiency in preventing work-related accidents may be improved through the adoption of a human resources management policy focused on the staff rejuvenation, in particular through the recruitment

of younger staff, and on the strengthening of the staff training, mainly in the case of the labour inspectors.

Furthermore, in order to improve the ACT local branches relative effectiveness and, concomitantly, the ACT overall effectiveness in preventing work-related accidents, several other targeted policy measures should be applied. One of these policy measures is to redesign the local branches areas of jurisdiction, in order to ensure a relatively higher allocation of their resources to the economic activity sectors which expose workers to higher levels of occupational risks and therefore present the highest work-related accidents incidence rates and that have a larger volume of employed population exposed to them. The implementation of such measure is expected to allow a much wiser allocation of the resources, essentially based on the volume of population employed and on the specificity of the sectors in which it predominantly operates. In addition to the reduction of the ratio of the number of workers to be served per labour inspector in those economic activity sectors with higher work-related accidents incidence rates, this policy adoption is also expected to induce a rise on the output levels and an increase on the level of sectoral expertise of each local branch staff. At the same time, such policy implementation is also likely to lead to a better capacity to develop a closer and more specialized monitoring of the workplaces, more focused on substantive compliance than on the compliance with merely formal aspects, essentially based on a more pedagogical and educational, rather than sancionatory, inspection approach, especially in those economic activity sectors with higher incidence rates of accidents at work. Moreover, these research findings suggest that the specificities of the economic activity sectors that present higher work-related accidents incidence rates pose special challenges to the ACT local branches, in terms of effectiveness. Their relative effectiveness improvement appears to require, in particular, a more specialized and customized approach, based on the implementation of other additional policy measures. This seems to be clearly the case of the creation of specialized sectoral inspection teams, primarily focused on the monitoring of the compliance with labour and OSH regulations in the workplaces of micro enterprises and SMEs operating in the sectors presenting the highest work-related accidents incidence rates (e.g. agriculture, forestry and fishing; mining and quarrying; manufacturing; construction; wholesale and retail trade; transportation and storage sector; and administrative and support service activities sector). The latter presupposes, however, the need for providing specialized and tailored training to the members of such specialized teams, in relation to the sectors of activity which will constitute their

targets. It is also likely to require, on the other hand, the implementation of continuous awareness-raising campaigns, specifically focused on the major risks of these sectors and on the most suitable measures to ensure their prevention and the protection of the safety and health of the workers. Such awareness-raising campaigns might include, besides the continuation of ongoing ACT OSH campaigns (e.g. health and safety for temporary workers and Iberian campaign of prevention of accidents at work) and the repetition of some of the ones launched by the ACT and already completed (e.g. occupational risk prevention in machinery and work equipment, improving working conditions in fishing sector, improving working conditions in the footwear industry, safety and health in agricultural and forestry work, safety and health at work of professional driving and inspection intervention in the private security sector) (ACT, 2017a), the inauguration of new ones. Considering this research findings, these new OSH campaigns would be specially welcome if aimed at the mining and quarrying sector, wholesale and retail trade sector, manufacturing (particularly in the garment industries, chemical industries, timber industry and agro-food industry), construction and administrative and support service activities sector (mainly regarding the technical assistance and maintenance, and the cleaning industries). In addition, the conclusions also suggest that improvement of the ACT local branches effectiveness is likely to require the adoption of several human resources policy measures, aimed at enlarging their staff level of education and training (especially in the case of the labour inspectors) and tackling their workforce ageing, predominantly through the adaptation of the job requirements, the assignment of age-specific jobs to older workers and the promotion of mixed-age working teams.

5.7 Main limitations

The methodological specificities inherent to the DEA technique and the restrictions on the data availability, recommend some caution in the interpretation of this research results.

The methodological concerns refer to the fact that the DEA assesses relative performance rather than absolute performance. They also include the need for the adoption of a specific protocol (Ali & Seiford, 1990; Allahyar & Rostamy-Malkhalifeh, 2015; Charnes et al., 1983), intended to ensure the non-negativity of the outcome levels, which, in turn, in spite of not changing the best practice frontier (Ali & Seiford, 1990) and the relative effectiveness of the local branches, produces, however, unrealistic and

unfeasible outcome levels and targets. In addition, these concerns also involve the use of the OLS regression of the performance scores on contextual variables, in order to support the identification of potential performance drivers, given the Simar & Wilson (2011) reservations regarding the use of second-stage OLS estimation.

The data limitations, on the other hand, derive from the possible existence of other exogenous factors, besides the ones considered, that may also help to better understand the ACT local branches relative efficiency and effectiveness, as well as from the fact that the data used in the present research was restricted to a one year period (the year of 2013).

5.8 Recommendations for further research

In the light of the aforesaid data limitation, regarding the use of the ACT data concerning just one year period (2013), the investigation of the time effect on the relative efficiency and effectiveness of the ACT local branches, in particular on the performance frontier, would constitute an interesting topic for further research.

Another challenging, innovative and very useful topic for future research could be the use of the DEA methodology to assess and to compare the relative efficiency and relative effectiveness of the European national labour inspectorates.

Finally, and considering the apparent contradictory results regarding the employers' size effect on the ACT local branches relative effectiveness, when compared to the ones concerning its impact on the occurrence of work-related accidents, it would be appreciated a deeper research on this specific topic.

Chapter 6 - Conclusion

Chapter 6 - Conclusion

6.1 Main conclusions

It is worth remembering, at this stage, that the main purpose of this research is to contribute to the improvement of the work-related accidents prevention effectiveness in Portugal.

To this end, it were identified three main paths through which the work-related accidents prevention effectiveness in Portugal might be improved: the improvement of the fatal work-related accidents prevention effectiveness; the improvement of the PMOSHMS effectiveness in preventing work-related accidents; and the improvement of the ACT effectiveness in preventing work-related accidents.

The results of this research show the conditions under which these improvement paths may contribute to the improvement of the overall work-related accidents prevention effectiveness in Portugal.

Regarding the improvement of the effectiveness of the prevention of occupational accidents by improving the effectiveness of the prevention of fatal work-related accidents, for example, the results lead to the conclusion that several variables have important effects on the occurrence of fatal work-related accidents (e.g., type of workplace, type of deviation that caused the accident, type of injury produced by the accident, employer's size, worker's age and worker's employment status), while others have no explanatory power (e.g., sex and its interaction with the worker's age and employer's economic activity sector). This research findings also allow us to conclude that fatal work-related accidents prevention effectiveness tends to be as lower as: higher is the worker's age; the more stable and predictable is the employment status; the larger is the employer's size; the workplace is in a trade/services area or in a industrial area; the worker is exposed to a deviation by overflow, overturn, leak, flow, vaporization or emission; and as the worker is likely to suffer a MSD, wound, fracture or amputation.

Moreover, and concerning the improvement of the work-related accidents prevention effectiveness through the improvement of the PMOSHMS effectiveness, the results of this research allow concluding that establishment's size (in terms of the average number of persons who work there, including employees, subcontractor's workers, temporary workers and self-employed workers), organization modality of the occupational safety services implemented in the establishment, number of different physical risk factors to

which the establishment's workers are exposed and the establishment's main economic activity sector, explain the number of work-related accidents occurring in a given establishment. Conversely, the results indicate that the organization modality of the occupational health services implemented in the establishment, level of coverage of the information actions carried out in the establishment, establishment's size in terms of the average number of other workers that work there (i.e. subcontractor's workers, temporary workers and self-employed workers), organization of health promotion programs in the establishment and organization of occupational risk prevention programs in the establishment, have no explanatory power for the work-related accidents occurring in the establishments. In addition, the research findings suggest that the work-related accidents prevention effectiveness in Portugal tends to be as lower as larger is the establishments's size (in terms of the average number of persons who work there, such as employees and workers of other employers, including subcontractors' workers, temporary workers and self-employed workers) and as lower as higher is the number of different physical risk factors to which establishment's workers are exposed. It also allows concluding that while the option for the implementation of internal occupational services increases the work-related accidents prevention effectiveness in Portugal, the option for its externalization is likely to induce its reduction. Furthermore, the results also indicate that the work-related accidents prevention effectiveness is likely to decline in establishments whose main economic activity sector is the secondary sector (manufacturing or construction establishments), while it is expected to improve regarding establishments of the primary and tertiary sectors.

As for the improvement of the work-related accidents prevention effectiveness through the improvement of the ACT effectiveness in preventing work-related accidents, the results of this research show that there are several factors influencing the ACT local branches relative effectiveness. This factors include, *inter alia*: the size of the local branches' areas of jurisdiction; the volume of employed population in the local branches' areas of jurisdiction; the number of workers served per labour inspector; the volume of employed population in the economic activity sectors of the local branches' areas of jurisdiction that expose the workers to higher levels of occupational risks (and which, typically, present higher work-related accidents incidence rates); the seniority level of the local branch staff; the time allocated by the directors to the management of the local branch; the level of education and training of the local branch staff (especially in the case of the labour inspectors); and the nature of the applied labour inspection ap-

proach and gesture. In particular, the results suggest that the work-related accidents prevention effectiveness in Portugal is likely to improve through: the reduction of the size of the local branches' areas of jurisdiction; the decrease of the volume of employed population in the local branches' areas of jurisdiction (and consequent reduction of the number of workers served per labour inspector); the decline on the volume of employed population in the economic activity sectors of the local branches' areas of jurisdiction which expose workers to higher levels of occupational risks; the reduction of the local branches' staff average seniority and the implementation of measures intended to tackle their staff ageing; the increase of the time allocated by the branches' directors to their management; the growth of the local branches' staff levels of education and training (mainly in the case of the labour inspectors); and the reinforcement of OSH awareness-raising campaigns. This research findings also highlight the fact that the work-related accidents prevention effectiveness in Portugal is also expected to improve with the generalized adoption of an inspection strategic approach and gesture mainly characterized by: the performance of a larger number of inspection visits, covering a greater number of employers and workplaces; the development of a closer and deeper follow-up and monitoring, with an emphasis on follow-up visits (rather than on first visits) and favoring inspection visits simultaneously aimed at controlling the compliance with the labour relations and OSH standards (to the detriment of inspection visits exclusively focused on either labour relations or OSH matters); and by the focus on the application of information, advice and executory inspection procedures which, despite their binding and mandatory nature, are not inherently sancionatory.

Finally, it is also worth mentioning that the DEA proved to be a suitable and particularly useful technique for assessing the Portuguese labour inspectorate performance in preventing work-related accidents, measuring its local branches relative efficiency and relative effectiveness, identifying their major weaknesses and challenges and highlighting their possible learning paths and the best practices that could be followed by the poorer performer's branches in order to improve their relative performance. It is therefore expected that this research can also contribute to the further use of DEA in such an under-researched area as the labour inspectorates' performance assessment.

6.2 Policy implications

When comparing the Portuguese fatal and non-fatal work-related accidents numbers and incidence rates with the ones presented by the other European countries, one realizes that there is a wide scope for the improvement of the work-related accidents prevention effectiveness in Portugal, although not knowing, *a priori*, how it can be achieved.

This research findings, however, highlight, for each one of the aforementioned improvement paths, the factors which have more effect (positive or negative) on the improvement of the work-related accidents prevention effectiveness in Portugal, thus suggesting potential ways through which the desired improvement might be attained.

Indeed, and in a strategic point of view, by stressing the main explanatory variables for the improvement of the work-related accidents prevention effectiveness in Portugal, this research ends up pinpointing the variables where the policy makers' attention as well as the scarce resources of the competent public authorities and of the other actors of the national system for the occupational risk prevention should be focused, in order to improve the work-related accidents prevention effectiveness in Portugal.

Building on this research results, the work-related accidents prevention effectiveness improvement in Portugal, especially in what concerns fatal accidents at work, is expected to improve through the concentration of the resources on the implementation of measures and public policies especially designed to prevent and protect the safety and health of older permanent workers, hired by large employers, operating in trade/services or industrial workplaces, exposed to deviations by overflow, overturn, leak, flow, vaporization or emission, likely to cause MSD, wounds, fractures or amputations.

In addition, this research findings also support that the work-related accidents prevention effectiveness improvement in Portugal depends on the extent to which the national resources are concentrated on the implementation of the following policy measures: to focus the inspection activity on the evaluation of the appropriateness and effectiveness of the OSHMS implemented at each employer/establishment (essentially measured in terms of its impact on reducing work-related accidents, rather than on the compliance of mere formal aspects), as well as on the practices of risk assessment and management; to promote the effective and *in situ* technical support to the implementation of OSHMS at the workplaces; to promote the practices of risk assessment and management; to launch awareness-raising campaigns on OSH services (e.g., modalities and technical and legal requirements). Moreover, the results of this research suggest that the

improvement of the work-related accidents prevention effectiveness in Portugal might also be achieved through the implementation of the following policy measures: the re-design of the ACT local branches areas of jurisdiction (in order to ensure a relatively higher allocation of their resources to monitor the workplaces operating in economic activity sectors which expose workers to higher levels of occupational risks, while reducing the number of workers to be served per labour inspector in such sectors' workplaces and increasing the level of sectoral expertise); the implementation of a closer and more specialized monitoring approach to the workplaces, through the creation of specialized sectoral inspection teams, primarily focused on the monitoring of the compliance with labour and OSH regulations in the workplaces operating in the sectors presenting the highest work-related accidents incidence rates (e.g. agriculture, forestry and fishing; mining and quarrying; manufacturing; construction; wholesale and retail trade; transportation and storage sector; and administrative and support service activities sector); the adoption of an inspection gesture more focused on substantive compliance than on the compliance with merely formal aspects, essentially based on a more pedagogical and educational, rather than sancionatory approach; the implementation of continuous awareness-raising campaigns, specifically focused on the major risks and on the most suitable measures to ensure their prevention, especially in the mining and quarrying sector, wholesale and retail trade sector, manufacturing (e.g., garment industries, chemical industries, timber industry and agro-food industry), construction and administrative and support service activities sector (e.g., technical assistance and maintenance, and cleaning industries); and the adoption, by the ACT, of several human resources policy measures, to enlarge their local branches' staff levels of education and training (especially in the case of the labour inspectors) and to tackle their workforce ageing (e.g., adaptation of job requirements, assignement of age-specific jobs to older workers and promotion of mixed-age working teams).

Moreover, considering the importance commonly recognized to the collection and timely provision of reliable and relevant statistical data on work-related accidents, in order to improve the quality of policy decisions in this field (European Commission, 2014; ILO, 2017), and taking into account the data limitations with which the present research was confronted, it would constitute important policy measures the ones intended to: reduce the current 2 years of publication backlog time of the Portuguese official statistics on accidents at work; ensure greater accuracy in the collection of data in respect to each work-related accident, in order to minimize the classification of observa-

tions in residual categories (such as ‘no information’) of the respective variables; enrich the Portuguese statistics on accidents at work, through the collection of additional data regarding other variables that might explain the occurrence of accidents at work (e.g., ‘type of work - working process’, ‘workstation’, ‘specific physical activity’ and his associated ‘material agent’, ‘material agent of the deviation’, number of hours of professional and OSH training, number of years of professional experience in the task/function, level of completed education, method of organization of work/task, performance evaluation system, objectives and rewards, monthly family income, number of risk assessments performed by occupational risk factor and workstation, and level of coverage of identified risk factors and workstations by the risk assessments performed); and improve the ‘Annex D’ form of the Annual Single Report on OSH Service Activities, namely through the revision of the processes of both the risk assessment data collection and the incidence rates estimation method and criteria.

6.3 Research limitations

The main limitations with which this research was confronted resulted essentially from some restrictions on the data availability as well as from some methodological aspects of the research.

Regarding the data limitations, it is especially important to highlight the absence of official statistics on fatal and non-fatal work-related accidents occurring in Portugal in the year 2015 and the lack of information for the years 2013 to 2015 in many individuals, with respect to variables such as ‘type of workplace’, ‘type of deviation’, ‘contact - mode of injury’, ‘material agent of contact - mode of injury’, ‘type of injury’ and ‘part of body injured’ (which determined their classification in their respective category ‘no information’), especially in the case of fatal accidents at work. While the former led to the impossibility of measure the representativeness level of the convenience sample used in the research on the predictors of fatal work-related accidents, the latter induced the exclusion, from the sample, of a total of 282 accidents at work (129 fatal and 153 non-fatal), corresponding to about 20% of all accidents at work initially included in the data, which penalized disproportionately the fatal work-related accidents (this reduction corresponded to a decrease of about 38% on the number fatal accidents at work considered and a decrease of 14% on the non-fatal ones). The data limitations also include the absence of data concerning a number of variables that could potentially explain the oc-

currence of accidents at work (e.g., ‘type of work - working process’, ‘workstation’, ‘specific physical activity’ and his associated ‘material agent’, ‘material agent of the deviation’, number of hours of professional and OSH training, number of years of professional experience in the task/function, level of completed education, method of organization of work/task, performance evaluation system, objectives and rewards, monthly family income, number of risk assessments performed per occupational risk factor and per workstation, and level of coverage of identified risk factors and workstations by the risk assessments performed). By impeding the inclusion of such variables, the aforesaid limitations prevented to test their statistical significance and, eventually, might have conditioned the results that could be obtained if they were considered. Other data limitations worth mentioning involve the absence of an aggregate indicator or composite index, likely to allow the assessment of the level of work-related accidents in a given establishment or employer with the joint consideration, through an appropriate weighting, of the different level of severity of the occurred fatal and non-fatal work-related accidents. Finally, other relevant limitation refers to the use of data regarding to just one year period in the researches on the PMOSHMS effectiveness and on the ACT performance assessment. The use of data concerning a wider period of analysis would ensure a higher robustness of the research results.

As for the methodological limitations of the present research, they refer mainly to the use of the DEA technique to assess the ACT local branches’ performance. They derive, not only from the fact that the DEA measures the relative performance (instead of the absolute performance), but also from the need to adopt a specific protocol intended to ensure the non-negativity of the outcome levels (Ali & Seiford, 1990; Allahyar & Rostamy-Malkhalifeh, 2015; Charnes et al., 1983) which, in spite of not changing the best practice frontier (Ali & Seiford, 1990) and the relative effectiveness of the local branches, it produces, however, unrealistic and unfeasible outcome levels and targets. They also result from the Simar & Wilson (2011) reservations regarding the use of second-stage OLS estimation, which was used in the regression of the performance scores on the contextual variables, in order to identify potential performance drivers of the ACT local branches.

6.4 Paths for future research

The reviewed literature, along with the results of the present research and some of its limitations, laid bare the interest on further deepening the research on some particular aspects on the field of the work-related accidents prevention effectiveness.

In fact, some mixing and apparently contradictory results obtained suggest the need for further research in some particular topics. This is clearly the case of the association between the employer's size and the employer's economic activity sector and the work-related accidents prevention effectiveness, which seem to provide a useful, interesting and challenging opportunity for future research.

Furthermore, considering that the causality patterns of fatal and non-fatal work-related accidents are different, thus implying the adoption of different prevention strategies, it might also constitute an interesting topic for future research the investigation of the predictors of non-fatal accidents at work in Portugal, with the use of an ordinal regression, to account for the different level of severity of the non-fatal accidents at work.

It would also constitute a particularly useful research theme the investigation of the critical success factors of the PMOSHMS implemented in establishments where no work-related accidents occurred, in order to allow the comparison of its results with the ones obtained in the present research.

Another innovative and valuable future research topic could be the use of the DEA methodology to assess and to compare the relative performance of the European national labour inspectorates in preventing work-related accidents.

In addition, and considering the abovementioned data limitations, especially the ones concerning the use of data regarding to just one year period, it would be particularly pertinent and stimulating, to replicate the researches on the critical factors of the PMOSHMS effectiveness in preventing accidents at work and on the ACT's performance assessment in preventing work-related accidents, with the inclusion of additional data, in order to extend the analysis period and account for the eventual time effect.

Finally, it would also be especially welcomed a research aimed at developing an indicator or composite index likely to allow the assessment of the level of work-related accidents in a given establishment or employer, accounting simultaneously, through an appropriate weighting, for the different level of severity of fatal and non-fatal work-related accidents.

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Annexes

Annex 1 - 'Annex Zero' of the Annual Single Report on OSH Service Activities

ECT INFORMAÇÃO SOBRE EMPREGO E CONDIÇÕES DE TRABALHO	 MINISTÉRIO DA ECONOMIA
RELATÓRIO ÚNICO	
Ano de referência 	
I. IDENTIFICAÇÃO DA ENTIDADE EMPREGADORA	
1. Número de Identificação Fiscal (NIF)	
2. Número de Identificação da Segurança Social (NISS)	
3. Nome ou designação social	
4. Localização e contactos da sede	
4.1 Morada	
4.2 Localidade	
4.3 Código postal -	
4.4 País	
4.5 Distrito ou Ilha / Município / Freguesia	
4.6 Telefone / Telemóvel	
4.7 Fax	
4.8 Endereço de correio electrónico	
5. Actividade económica principal (CAE)	
6. Situação perante a actividade, motivo e período	
6.1 Situação	
6.2 Motivo	
6.3 Datas: Início / Fim	
7. Natureza jurídica	
8. Data de constituição	
9. Total de pessoas ao serviço	
10. Número de trabalhadores por conta de outrem	
II. IDENTIFICAÇÃO DA(S) UNIDADE(S) LOCAL(IS) (ESTABELECIMENTOS)	
Número da unidade local (estabelecimento)	
2. Nome	
3. Localização e contactos da unidade local	
3.1 Morada	
3.2 Localidade	
3.3 Código postal -	
3.4 País	
3.5 Distrito ou Ilha / Município / Freguesia	
3.6 Telefone / Telemóvel	
3.7 Fax	
3.8 Endereço de correio electrónico	
4. Actividade económica principal (CAE)	
5. Situação perante a actividade, motivo e período	
5.1 Situação	
5.2 Motivo	
5.3 Datas: Início / Fim	
6. Total de pessoas ao serviço	
7. Número de trabalhadores por conta de outrem	
III. PESSOAS AO SERVIÇO	
1. Pessoas ao serviço da entidade empregadora	
1.1 Trabalhadores por conta de outrem	
2. Destacamentos de trabalhadores para o estrangeiro, ao longo do ano	
2.1 Número de trabalhadores destacados	
2.2 Número de destacamentos	
IV. FILIAÇÃO SINDICAL E FILIAÇÃO EM ASSOCIAÇÕES DE EMPREGADORES	
1. Número de trabalhadores sindicalizados, em 31 de Outubro	
2. Inscrição em Associações de empregadores? Sim ☐ Não ☐	
2.1 Associação	
V. TRABALHO SUPLEMENTAR	
1. Foram realizadas horas suplementares ao longo do ano? Sim ☐ Não ☐	
2. Em caso afirmativo, a relação nominal dos trabalhadores que prestaram trabalho suplementar durante o período de referência, com discriminação do número de horas ao abrigo dos n.ºs 1 e 2 do art. n.º 227 da Lei 7/2009, foi visada pela comissão de trabalhadores ou, na sua falta, em caso de trabalhador filiado, pelo respectivo sindicato? Sim ☐ Não ☐	
VI. TRABALHADORES TEMPORÁRIOS NA EMPRESA UTILIZADORA (A preencher somente pelas entidades utilizadoras de trabalho temporário durante o ano de referência do relatório)	
1. Número de Trabalhadores temporários	
1.1 Em 31 de Outubro	
1.2 Em 31 de Dezembro	
1.3 Número médio durante o ano	
2. Fluxo de entradas ou saídas de pessoas em prestação de trabalho temporário, ao longo do ano	
2.1 Entradas durante o ano H	
2.2 Saídas durante o ano H	

VII. TRABALHADORES COM PERDA OU ANOMALIA DE ESTRUTURAS OU FUNÇÕES DO CORPO COM IMPLICAÇÕES NA PRESTAÇÃO DE TRABALHO										
	Menos de 18 anos		De 18 a 34 anos		De 35 a 44 anos		De 45 a 64 anos		65 e mais anos	
1. Distribuição por grupos etários - TOTAL	H		H		H		H		H	
	M		M		M		M		M	
1.1 Com grau de incapacidade inferior a 60%	H		H		H		H		H	
	M		M		M		M		M	
1.2 Com grau de incapacidade de 60% e inferior a 80%	H		H		H		H		H	
	M		M		M		M		M	
1.3 Com grau de incapacidade igual ou superior a 80%	H		H		H		H		H	
	M		M		M		M		M	
	Inferior ao 3º ciclo ens. básico		3º ciclo ens. básico		Ensino Secundário		Ensino pós-sec. não superior		Ensino Superior	
2. Distribuição por habilitação literária - TOTAL	H		H		H		H		H	
	M		M		M		M		M	
2.1 Com grau de incapacidade inferior a 60%	H		H		H		H		H	
	M		M		M		M		M	
2.2 Com grau de incapacidade de 60% e inferior a 80%	H		H		H		H		H	
	M		M		M		M		M	
2.3 Com grau de incapacidade igual ou superior a 80%	H		H		H		H		H	
	M		M		M		M		M	

VIII. DADOS ECONÓMICOS DA ENTIDADE EMPREGADORA											
1. Volume de Negócios (VN)					€	Ano a que se refere o VN					
2. Capital social (caso não exista, ponha um zero na última quadrícula)					€						
Repartição percentual:	2.1 Privado Nacional		.		%	2.2 Estrangeiro		.		%	
						2.3 Público Nacional		.		%	
3. Encargos de formação profissional											
3.1 Montante financiado pela entidade emp.					€	3.2 Financiamento externo à entidade emp.					€
3.1.1 Montante correspondente à remuneração das horas despendidas em formação					€	3.2.1 Do Fundo Social Europeu (FSE)					€
3.1.2 Restante financiamento da entidade empregadora					€	3.2.2 De outras fontes de financiamento					€
3.3 Encargos globais com formação profissional (3.1 + 3.2)					€						
4. Encargos no âmbito da segurança e saúde no trabalho											
4.1 Na organização dos serviços de segurança e saúde no trabalho					€	4.4 Na formação, informação e consulta					€
4.2 Na organização/modificação dos espaços de trabalho					€	4.5 Outros					€
4.3 Na aquisição de bens ou equipamentos					€	4.6 TOTAL					€

IX. OUTROS DADOS COMPLEMENTARES DA ENTIDADE EMPREGADORA											
(A preencher somente por entidades com 10 ou mais trabalhadores a 31 de Outubro)											
1. Valor Acrescentado Bruto (VAB)					€	Ano a que se refere o VAB					
1.1 Custos com pessoal					€	1.4 Custos e perdas financeiras					€
1.2 Amortizações do exercício					€	1.5 Imposto sobre o rendimento					€
1.3 Provisões do exercício					€	1.6 Resultado líquido do exercício					€
2. Encargos com regimes complementares de protecção social											
2.1 Encargos suportados e administrados, pela entidade empregadora											
2.1.1 Subsídio por doença e doença profissional					€		☐				
2.1.2 Pensões de velhice, de invalidez e de sobrevivência					€		☐				
2.1.3 Outras prestações de segurança social					€		☐				
2.2 Encargos suportados, mas não administrados, pela entidade empregadora											
2.2.1 Subsídio por doença e doença profissional					€		☐				
2.2.2 Pensões de velhice, de invalidez e de sobrevivência					€		☐				
2.2.3 Outras prestações de segurança social					€		☐				
2.3 Encargos de acção e apoio social					€						
3. Potencial máximo anual (horas trabalháveis, durante o ano)											
4. Nº de horas não trabalhadas durante o ano, dos trabalhadores por conta de outrem, correspondentes aos dias normais de trabalho											
4.1 Motivo			4.2 Número de horas de ausência remuneradas			4.3 Número de horas de ausência não remuneradas					
		H		M		H		M			
	...		...		...		...		...		

Annex 2 - 'Annex D' of the Annual Single Report on OSH Service Activities

	MINISTÉRIO DA ECONOMIA Autoridade para as Condições de Trabalho Gabinete de Estratégia e Estudos		MINISTÉRIO DA SAÚDE Direcção Geral da Saúde

ANEXO D - RELATORIO ANUAL DA ACTIVIDADE DO SERVIÇO DE SEGURANÇA E SAÚDE NO TRABALHO

Número de Identificação Fiscal (NIF)	Número de Identificação da Segurança Social (NISS)	Número da unidade local (estabelecimento)	Ano de referência

I - UNIDADE LOCAL (ESTABELECIMENTO) - A preencher também para a sede

1. Existiram trabalhadores ao serviço em algum período do ano de referência do relatório? Sim ☐ Não ☐
2. Actividade económica principal (CAE) da unidade local em 31 de Dezembro
3. Número médio de trabalhadores afectos à unidade local (estabelecimento), no ano:

	Total	Homens	Mulheres
3.1 Vinculados por contrato de trabalho ou equiparado ao empregador responsável pelo relatório			
3.1.1 A trabalhar na unidade local (estabelecimento)			
3.1.2 A trabalhar fora da unidade local (estabelecimento)			
3.1.2.1 Trabalhadores temporários cedidos por contrato de utilização			
3.1.2.2 Trabalhadores em regime de cedência ocasional			
3.1.2.3 Outros trabalhadores (em regime de teletrabalho ou trabalhadores no domicílio)			
3.2 Outros trabalhadores a trabalhar na unidade local (estabelecimento)			
3.2.1 Trabalhadores temporários cedidos por contrato de utilização			
3.2.2 Trabalhadores independentes e trabalhadores ao serviço de empresas prestadoras de serviços			
3.2.3 Trabalhadores em regime de cedência ocasional			
3.3 TOTAL (3.1 + 3.2)			
4. Número total de horas efectivamente trabalhadas (incluindo as suplementares) durante o ano, pelos trabalhadores declarados em 3.1.1

II - NATUREZA DA MODALIDADE ADOPTADA NA ORGANIZAÇÃO DOS SERVIÇOS DE SEGURANÇA E SAÚDE NO TRABALHO

1. Foram organizados os serviços de segurança no trabalho? Sim ☐ Não ☐
2. Foram organizados os serviços de saúde no trabalho? Sim ☐ Não ☐
3. Quantos trabalhadores estão afectos à organização da estrutura interna de 1^{os} socorros, combate a incêndios e evacuação de instalações?
4. As actividades de segurança e saúde no trabalho foram organizadas: Em conjunto ☐ Em separado ☐
5. Especifique a modalidade:

5.1 No domínio da segurança:	5.2 No domínio da saúde:
5.1.1 Serviço interno ☐	5.2.1 Serviço interno ☐
5.1.2 Serviço comum/partilhado ☐	5.2.2 Serviço comum/partilhado ☐
5.1.3 Serviço externo ☐	5.2.3 Serviço externo ☐
5.1.4 Actividades exercidas pelo empregador ☐	5.2.4 Serviço Nacional/Regional de Saúde ☐
5.1.5 Actividades exercidas pelo trabalhador designado ☐	
6. Foram complementados os serviços especificados em 5.? Sim ☐ Não ☐

III- PESSOAL DOS SERVIÇOS DE SEGURANÇA E SAÚDE NO TRABALHO

1. Serviços internos, comuns/partilhados e/ou externos

1.1 Indique o número de técnicos em cada grupo profissional, que exerceram actividade efectiva na unidade local (estabelecimento):

1.1.1 Médicos do trabalho	1.1.2 Enfermeiros	1.1.3 Técnicos Superiores de SHT	1.1.4 Técnicos de SHT	1.1.5 Outro pessoal

1.2 Médico(s) do trabalho:

1.2.1 Nome do(s) Médico(s) do trabalho:
(Coloque na primeira linha o nome do médico responsável)

1.2.2 Nº(s) da cédula profissional

1.2.3 Nº de horas mensais de afectação
horas minutos

1.3 Técnico(s) de Segurança e Higiene do Trabalho:

1.3.1 Nome do(s) técnico(s) de Segurança e Higiene do Trabalho:

1.3.2 Nº(s) Certificado de Aptidão Profissional (CAP)

/ /

OU

(para candidaturas apresentadas a partir de 2 de Janeiro de 2009, inclusive)

1.4 Director/Responsável dos Serviços:

1.4.1 De Segurança

1.4.1.1 NIF

1.4.1.2 Nome

1.4.2 De Saúde

1.4.2.1 NIF

1.4.2.2 Nome

1.5 Empregador:

1.5.1 Nome

1.5.2 nº autorização

1.6 Trabalhador Designado:

1.6.1 Nome do Trabalhador Designado:

1.6.2 nº autorização

1.7 Nome do Representante do empregador para o acompanhamento dos serviços comuns/partilhados ou externos:

2. No caso de Serviços Externos, indicar denominação e número de identificação fiscal da(s) entidade(s) prestadora(s):

2.1 Serviços de Segurança

2.1.1 NIF

2.1.2 Denominação:

2.1.3 Tipo

2.2 Serviços de Saúde:

2.2.1 NIF

2.2.2 Denominação:

2.2.3 Tipo

IV - ACTIVIDADE(S) DO(S) SERVIÇO(S) DE SEGURANÇA E SAÚDE NO TRABALHO

1. Foram organizados programas de prevenção:

1.1 Programa de prevenção de riscos profissionais: Sim ☐ Não ☐

1.2 Programa de promoção da saúde: Sim ☐ Não ☐

1.3 Programa de vigilância da saúde: Sim ☐ Não ☐

2. Foram realizadas Auditorias?

Sim ☐ Não ☐

3. Foram realizadas Inspeções?

Sim ☐ Não ☐

4. Acções de informação, consulta e formação aos trabalhadores

4.1 Informação aos trabalhadores sobre os riscos inerentes à sua actividade profissional

4.1.1 Foram realizadas acções de informação? Sim ☐ Não ☐

4.1.1.1 Situação contemplada

4.1.1.2 Nº de acções realizadas

4.1.1.3 Nº de destinatários

4.2 Consulta aos trabalhadores nos domínios da Segurança e Saúde no Trabalho

4.2.1 Foram realizadas acções de consulta? Sim ☐ Não ☐

4.2.1.1 Razão da consulta

4.2.1.2 Nº de acções realizadas

4.2.1.3 Nº de participantes

4.3 Formação dos trabalhadores nos domínios da Segurança e Saúde no Trabalho

4.3.1 Foram realizadas acções de formação? Sim ☐ Não ☐

4.3.1.1 Tema da formação

4.3.1.2 Nº de acções realizadas

4.3.1.3 Nº de participantes
H M

5. Identificação, avaliação e controlo dos factores de risco

5.1 Foram identificados factores de risco físico?

Sim ☐ Não ☐

5.1.1 Agente [][][] ...	5.1.2 Nº de trabalhadores expostos H [][][][] M [][][][]	5.1.3 Nº de avaliações efectuadas [][][]	5.1.4 Medidas de prevenção adoptadas [][][] [][][] ...

5.2 Foram identificados factores de risco químico?

Sim ☐ Não ☐

5.2.1 EINECS (nº CE) Nº ordem [][][] - Código [][][][][][][][]	5.2.2 Identificação do agente [][][][]	5.2.3 Menção ou frase de risco R [][][]	5.2.4 Nº de trab. expostos H [][][][] M [][][][]	5.2.5 Nº de avaliações efectuadas [][][]	5.2.6 Medidas de prev. adoptadas [][][] [][][] ...

5.3 Foram identificados factores de risco biológico?

Sim ☐ Não ☐

5.3.1 Agente [][][][] ...	5.3.2 Identificação do agente [][][][]	5.3.3 Classificação do agente [][][]	5.3.4 Nº de trabalhadores expostos H [][][][] M [][][][]	5.3.5 Nº de avaliações efectuadas [][][]	5.3.6 Medidas de prevenção adoptadas [][][] [][][] ...

5.4 Foram identificados factores de risco relacionados com a actividade, capazes de originar alterações do sistema músculo-esquelético?

Sim ☐ Não ☐

5.4.1 Agente [][][] ...	5.4.2 Nº de trabalhadores expostos H [][][][] M [][][][]	5.4.3 Nº de avaliações efectuadas [][][]	5.4.4 Medidas de prevenção adoptadas [][][] [][][] ...

5.5 Foram identificados factores de risco psicossociais e organizacionais?

Sim ☐ Não ☐

5.5.1 Agente [][][] ...	5.5.2 Nº de trabalhadores expostos H [][][][] M [][][][]	5.5.3 Nº de avaliações efectuadas [][][]	5.5.4 Medidas de prevenção adoptadas [][][] [][][] ...

5.6 Foram identificados outros factores de risco para a segurança e saúde dos trabalhadores no trabalho?

Sim ☐ Não ☐

5.6.1 Agente [][][] ...	5.6.2 Nº de trabalhadores expostos H [][][][] M [][][][]	5.6.3 Nº de avaliações efectuadas [][][]	5.6.4 Medidas de prevenção adoptadas [][][] [][][] ...

6. Promoção e vigilância da saúde

6.1 Foram realizados exames de admissão, periódicos e/ou ocasionais?

Sim ☐ Não ☐

		Escalações etárias				
		Total	Inferior a 18 anos	18 e 19 anos	20 a 49 anos	50 e mais anos
Total de exames	H	[][][][]	H [][][][]	H [][][][]	H [][][][]	H [][][][]
	M	[][][][]	M [][][][]	M [][][][]	M [][][][]	M [][][][]
6.1.1 Total de exames de admissão	H	[][][][]	H [][][][]	H [][][][]	H [][][][]	H [][][][]
	M	[][][][]	M [][][][]	M [][][][]	M [][][][]	M [][][][]
6.1.2 Total de exames periódicos	H	[][][][]	H [][][][]	H [][][][]	H [][][][]	H [][][][]
	M	[][][][]	M [][][][]	M [][][][]	M [][][][]	M [][][][]
6.1.3 Total de exames ocasionais	H	[][][][]	H [][][][]	H [][][][]	H [][][][]	H [][][][]
	M	[][][][]	M [][][][]	M [][][][]	M [][][][]	M [][][][]
6.1.3.1 Mudança de posto de trabalho	H	[][][][]	H [][][][]	H [][][][]	H [][][][]	H [][][][]
	M	[][][][]	M [][][][]	M [][][][]	M [][][][]	M [][][][]
6.1.3.2 Alterações no posto de trabalho	H	[][][][]	H [][][][]	H [][][][]	H [][][][]	H [][][][]
	M	[][][][]	M [][][][]	M [][][][]	M [][][][]	M [][][][]
6.1.3.3 Regresso ao trab. após ausência superior a 30 dias	H	[][][][]	H [][][][]	H [][][][]	H [][][][]	H [][][][]
	M	[][][][]	M [][][][]	M [][][][]	M [][][][]	M [][][][]
6.1.3.3.1 Pós baixa por acidente de trabalho	H	[][][][]	H [][][][]	H [][][][]	H [][][][]	H [][][][]
	M	[][][][]	M [][][][]	M [][][][]	M [][][][]	M [][][][]
6.1.3.3.2 Pós baixa por doença	H	[][][][]	H [][][][]	H [][][][]	H [][][][]	H [][][][]
	M	[][][][]	M [][][][]	M [][][][]	M [][][][]	M [][][][]
6.1.3.4 Inicialização do médico	H	[][][][]	H [][][][]	H [][][][]	H [][][][]	H [][][][]
	M	[][][][]	M [][][][]	M [][][][]	M [][][][]	M [][][][]
6.1.3.5 Pedido do trabalhador	H	[][][][]	H [][][][]	H [][][][]	H [][][][]	H [][][][]
	M	[][][][]	M [][][][]	M [][][][]	M [][][][]	M [][][][]
6.1.3.6 Por cessação do contrato de trabalho	H	[][][][]	H [][][][]	H [][][][]	H [][][][]	H [][][][]
	M	[][][][]	M [][][][]	M [][][][]	M [][][][]	M [][][][]
6.1.3.7 Outras razões	H	[][][][]	H [][][][]	H [][][][]	H [][][][]	H [][][][]
	M	[][][][]	M [][][][]	M [][][][]	M [][][][]	M [][][][]

6.2 Foram realizados exames complementares? Sim ☐ Não ☐

6.2.1 Exame [][][] ...	6.2.2 Nº total de exames [][][][] ...	6.2.3 Factor de risco [][][][] ...

6.3 Foram realizadas acções de imunização? Sim ☐ Não ☐

6.3.1 Vacina [][][] ...	6.3.2 Nº de inoculações [][][][] ...	6.3.3 Nº de trabalhadores H [][][][] M [][][][] ...

6.4 Foram realizadas acções de promoção da saúde no trabalho? Sim ☐ Não ☐

6.4.1 Actividade desenvolvida [][][] ...	6.4.2 Nº de acções de promoção da saúde realizadas [][][][] ...	6.4.3 Nº de trabalhadores abrangidos H [][][][] M [][][][] ...

V - ACIDENTES DE TRABALHO E DOENÇAS PROFISSIONAIS

1. Ocorreram acidentes de trabalho, no tempo de trabalho, com trabalhadores indicados no quadro I, questão 3.1.1? Sim ☐ Não ☐

1.1 Número de acidentes de trabalho e de dias de trabalho perdidos com baixa, segundo o escalão de duração da baixa
(não incluir neste item a informação referente aos acidentes de trajeto)

		Total	Inferior a 1 dia (sem dar lugar a baixa)	1 a 3 dias de baixa	4 a 30 dias de baixa	Superior a 30 dias de baixa	Mortal
1.1.1 Nº de acidentes de trabalho (AT) ocorridos no ano de referência do relatório	H	[][][][]	[][][][]	[][][][]	[][][][]	[][][][]	[][][]
	M	[][][][]	[][][][]	[][][][]	[][][][]	[][][][]	[][][]
1.1.2 Nº de dias de trabalho perdidos na sequência de AT ocorridos no ano de referência do relatório	H	[][][][]		[][][][]	[][][][]	[][][][]	
	M	[][][][]		[][][][]	[][][][]	[][][][]	
1.1.3 Nº de dias de trab. perdidos no ano de ref. do relatório, na seq. dos AT ocorridos em anos anteriores	H	[][][][]		[][][][]	[][][][]	[][][][]	
	M	[][][][]		[][][][]	[][][][]	[][][][]	

1.2 Cálculo das taxas de frequência e gravidade dos acidentes de trabalho não mortais, segundo as fórmulas:

1.2.1 Taxa de frequência: $TF = (\text{Nº de acidentes de trab.} / \text{Nº horas efectivamente trabalhadas}) \times 1.000.000$ = [][][][] , [][][]

1.2.2 Taxa de gravidade: $Tg = (\text{Nº de dias perdidos} / \text{Nº horas efectivamente trabalhadas}) \times 1.000.000$ = [][][][] , [][][]

2. Ocorreram acidentes de trabalho, no tempo de trabalho, com trabalhadores indicados no quadro I, questão 3.2? Sim ☐ Não ☐

2.1 Número de acidentes de trabalho
(não incluir neste item a informação referente aos acidentes de trajeto)

		Total	Não mortal	Mortal
2.1.1 Nº de acidentes de trabalho	H	[][][][]	[][][][]	[][][]
	M	[][][][]	[][][][]	[][][]

2.2 Cálculo da taxa de incidência dos acidentes de trabalho totais e mortais, segundo as fórmulas:

2.2.1 Taxa de incidência (Total AT): $TIT = (\text{Nº de AT Totais} / \text{Nº total de trab. em I - 3.2}) \times 1.000$ = [][][][] , [][][]

2.2.2 Taxa de incidência (AT mortais): $TIM = (\text{Nº de AT mortais} / \text{Nº total de trab. em I - 3.2}) \times 1.000$ = [][][][] , [][][]

3. Taxa de incidência dos acidentes de trabalho totais e mortais, ocorridos com os trabalhadores indicados no quadro I, questões 3.1.1 e I - 3.2

3.1 Taxa de incidência (Total AT): $TIT = (\text{Nº de AT Totais} / \text{Nº total de trab. em I - 3.1.1 e I - 3.2}) \times 1.000$ = [][][][] , [][][]

3.2 Taxa de incidência (AT mortais): $TIM = (\text{Nº de AT mortais} / \text{Nº total de trab. em I - 3.1.1 e I - 3.2}) \times 1.000$ = [][][][] , [][][]

4. Doenças Profissionais de participação obrigatória

4.1 Foram participadas doenças no ano de referência do relatório? Sim ☐ Não ☐

4.1.1 Factor de risco Código: [][][][] Designação: [][][][] ...	4.1.2 Doença profissional [][][][] ...	4.1.3 Número de casos participados H [][][][] M [][][][] ...

4.2 Foram confirmadas doenças no ano de referência do relatório? Sim ☐ Não ☐

4.2.1 Factor de risco Código: [][][][] Designação: [][][][] ...	4.2.2 Doença profissional [][][][] ...	4.2.3 Número de casos confirmados H [][][][] M [][][][] ...

Appendices

Appendix 1 - Sample data regarding the work-related accidents occurring between 1 January 2013 and 22 October 2015 whose inquiry was concluded by the ACT during that period

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
1	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	64	1	4	0	0	0
2	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	47	1	4	0	0	0
3	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	54	1	4	0	0	0
4	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	67	1	4	0	0	0
5	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	35	1	4	0	0	0
6	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	39	1	4	0	0	0
7	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	40	1	4	0	0	0
8	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	54	1	4	0	0	0
9	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	53	1	4	0	0	0
10	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	55	1	4	0	0	0
11	1	2	0	1	2	0	2	0	1	3	0	0	1	0	0	52	1	4	0	0	0
12	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	53	1	4	0	0	0
13	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	49	1	4	0	0	0
14	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	46	1	4	0	0	0
15	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	56	1	4	0	0	0
16	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	45	1	4	0	0	0
17	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	45	1	4	0	0	0
18	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	61	1	4	0	0	0
19	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	56	1	4	0	0	0
20	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	45	1	4	0	0	0
21	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	36	1	4	0	0	0
22	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	44	1	4	0	0	0
23	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	44	1	4	0	0	0
24	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	36	1	4	0	0	0
25	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	25	1	4	0	0	0
26	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	58	1	4	0	0	0
27	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	19	1	4	0	0	0
28	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	43	1	4	0	0	0
29	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	60	1	4	0	0	0
30	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	52	1	4	0	0	0
31	0	3	0	0	1	1	2	0	1	3	0	0	1	0	0	34	1	4	0	0	0
32	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	62	1	4	0	0	0
33	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	28	1	4	0	0	0
34	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	43	1	4	0	0	0
35	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	57	1	4	0	0	0
36	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	44	1	4	0	0	0
37	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	57	1	4	0	0	0
38	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	42	1	4	0	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
39	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	45	1	4	0	0	0
40	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	56	1	4	0	0	0
41	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	57	1	4	0	0	0
42	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	28	1	4	0	0	0
43	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	39	1	4	0	0	0
44	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	61	1	4	0	0	0
45	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	56	1	4	0	0	0
46	0	3	0	0	1	1	2	0	1	3	0	0	1	0	0	46	1	4	0	0	0
47	0	2	0	1	2	0	1	1	0	3	0	0	1	0	0	37	1	4	0	0	0
48	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	27	1	4	0	0	0
49	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	65	1	4	0	0	0
50	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	21	1	3	0	0	1
51	1	1	1	0	2	0	3	0	0	3	0	0	3	0	1	24	1	3	0	0	1
52	1	1	1	0	1	1	3	0	0	3	0	0	3	0	1	46	0	3	0	0	1
53	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	63	1	3	0	0	1
54	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	35	1	3	0	0	1
55	0	1	1	0	2	0	2	0	1	3	0	0	3	0	1	22	1	3	0	0	1
56	0	2	0	1	2	0	2	0	1	3	0	0	3	0	1	42	0	3	0	0	1
57	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	43	1	3	0	0	1
58	0	1	1	0	2	0	2	0	1	3	0	0	3	0	1	32	1	3	0	0	1
59	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	63	1	3	0	0	1
60	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	62	1	3	0	0	1
61	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	28	1	3	0	0	1
62	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	23	1	3	0	0	1
63	0	1	1	0	2	0	3	0	0	3	0	0	2	1	0	40	1	3	0	0	1
64	0	1	1	0	2	0	3	0	0	3	0	0	1	0	0	23	1	3	0	0	1
65	0	1	1	0	2	0	2	0	1	3	0	0	3	0	1	21	0	3	0	0	1
66	0	1	1	0	1	1	3	0	0	3	0	0	2	1	0	37	1	3	0	0	1
67	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	54	1	3	0	0	1
68	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	33	1	3	0	0	1
69	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	50	1	3	0	0	1
70	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	25	1	3	0	0	1
71	0	1	1	0	2	0	2	0	1	3	0	0	3	0	1	47	1	3	0	0	1
72	0	1	1	0	2	0	3	0	0	3	0	0	2	1	0	37	1	3	0	0	1
73	0	2	0	1	2	0	3	0	0	3	0	0	3	0	1	52	0	3	0	0	1
74	0	1	1	0	2	0	3	0	0	3	0	0	3	0	1	22	1	3	0	0	1
75	0	1	1	0	2	0	3	0	0	3	0	0	3	0	1	27	1	3	0	0	1
76	0	1	1	0	2	0	3	0	0	3	0	0	2	1	0	44	0	3	0	0	1
77	1	3	0	0	2	0	3	0	0	3	0	0	3	0	1	28	1	2	0	1	0
78	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	24	1	2	0	1	0
79	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	44	1	2	0	1	0
80	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	25	1	2	0	1	0
81	1	3	0	0	2	0	3	0	0	3	0	0	3	0	1	27	1	2	0	1	0
82	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	40	1	2	0	1	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
83	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	56	1	2	0	1	0
84	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	23	1	2	0	1	0
85	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	50	1	2	0	1	0
86	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	56	1	2	0	1	0
87	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	34	1	2	0	1	0
88	1	3	0	0	1	1	3	0	0	3	0	0	3	0	1	46	1	2	0	1	0
89	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	36	1	2	0	1	0
90	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	48	1	2	0	1	0
91	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	51	1	2	0	1	0
92	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	50	1	2	0	1	0
93	1	3	0	0	1	1	3	0	0	3	0	0	1	0	0	55	1	2	0	1	0
94	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	49	1	2	0	1	0
95	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	54	1	2	0	1	0
96	1	1	1	0	2	0	3	0	0	3	0	0	1	0	0	48	1	2	0	1	0
97	1	3	0	0	2	0	3	0	0	3	0	0	3	0	1	44	1	2	0	1	0
98	1	3	0	0	2	0	3	0	0	3	0	0	3	0	1	58	1	2	0	1	0
99	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	22	1	2	0	1	0
100	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	36	1	2	0	1	0
101	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	38	1	2	0	1	0
102	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	56	1	2	0	1	0
103	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	39	1	2	0	1	0
104	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	48	1	2	0	1	0
105	1	1	1	0	2	0	3	0	0	3	0	0	2	1	0	25	1	2	0	1	0
106	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	46	1	2	0	1	0
107	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	28	1	2	0	1	0
108	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	56	1	2	0	1	0
109	1	1	1	0	2	0	3	0	0	3	0	0	3	0	1	37	1	2	0	1	0
110	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	56	1	2	0	1	0
111	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	47	1	2	0	1	0
112	1	1	1	0	2	0	3	0	0	3	0	0	1	0	0	41	1	2	0	1	0
113	1	3	0	0	2	0	3	0	0	3	0	0	3	0	1	50	1	2	0	1	0
114	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	49	1	2	0	1	0
115	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	38	1	2	0	1	0
116	0	2	0	1	2	0	3	0	0	3	0	0	2	1	0	66	1	2	0	1	0
117	0	2	0	1	2	0	2	0	1	3	0	0	2	1	0	63	1	2	0	1	0
118	0	2	0	1	2	0	3	0	0	3	0	0	2	1	0	41	1	2	0	1	0
119	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	43	1	2	0	1	0
120	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	36	1	2	0	1	0
121	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	38	1	2	0	1	0
122	0	2	0	1	2	0	1	1	0	3	0	0	3	0	1	55	1	2	0	1	0
123	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	38	1	2	0	1	0
124	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	22	1	2	0	1	0
125	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	36	1	2	0	1	0
126	0	3	0	0	2	0	1	1	0	3	0	0	3	0	1	24	1	2	0	1	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
127	0	1	1	0	2	0	2	0	1	3	0	0	1	0	0	55	1	2	0	1	0
128	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	50	1	2	0	1	0
129	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	45	1	2	0	1	0
130	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	38	1	2	0	1	0
131	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	48	1	2	0	1	0
132	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	27	1	2	0	1	0
133	0	2	0	1	2	0	2	0	1	3	0	0	1	0	0	44	0	2	0	1	0
134	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	44	1	2	0	1	0
135	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	34	1	2	0	1	0
136	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	36	1	2	0	1	0
137	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	53	1	2	0	1	0
138	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	42	0	2	0	1	0
139	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	32	1	2	0	1	0
140	0	1	1	0	2	0	3	0	0	3	0	0	3	0	1	46	0	2	0	1	0
141	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	48	1	2	0	1	0
142	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	48	1	2	0	1	0
143	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	25	1	2	0	1	0
144	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	42	1	2	0	1	0
145	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	63	1	2	0	1	0
146	0	2	0	1	2	0	3	0	0	3	0	0	1	0	0	43	1	2	0	1	0
147	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	33	1	2	0	1	0
148	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	34	1	2	0	1	0
149	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	18	1	2	0	1	0
150	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	47	1	2	0	1	0
151	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	41	1	2	0	1	0
152	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	35	1	2	0	1	0
153	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	30	1	2	0	1	0
154	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	37	1	2	0	1	0
155	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	40	1	2	0	1	0
156	0	2	0	1	2	0	1	1	0	3	0	0	2	1	0	42	0	2	0	1	0
157	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	36	1	2	0	1	0
158	0	1	1	0	2	0	2	0	1	3	0	0	3	0	1	36	0	2	0	1	0
159	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	36	1	2	0	1	0
160	0	1	1	0	2	0	2	0	1	3	0	0	1	0	0	24	1	2	0	1	0
161	0	1	1	0	2	0	2	0	1	3	0	0	3	0	1	57	1	2	0	1	0
162	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	29	1	2	0	1	0
163	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	49	1	2	0	1	0
164	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	42	1	2	0	1	0
165	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	33	1	2	0	1	0
166	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	43	1	2	0	1	0
167	0	1	1	0	2	0	3	0	0	3	0	0	1	0	0	56	1	2	0	1	0
168	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	63	1	2	0	1	0
169	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	21	1	2	0	1	0
170	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	30	1	2	0	1	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
171	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	50	1	2	0	1	0
172	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	31	1	2	0	1	0
173	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	52	1	2	0	1	0
174	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	45	1	2	0	1	0
175	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	62	1	2	0	1	0
176	0	2	0	1	2	0	2	0	1	3	0	0	3	0	1	22	1	2	0	1	0
177	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	34	1	2	0	1	0
178	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	39	1	2	0	1	0
179	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	41	1	2	0	1	0
180	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	33	1	2	0	1	0
181	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	46	1	2	0	1	0
182	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	54	1	2	0	1	0
183	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	52	1	2	0	1	0
184	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	69	1	2	0	1	0
185	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	32	1	2	0	1	0
186	0	2	0	1	2	0	2	0	1	3	0	0	1	0	0	49	1	2	0	1	0
187	0	1	1	0	2	0	2	0	1	3	0	0	1	0	0	37	1	2	0	1	0
188	0	1	1	0	2	0	3	0	0	3	0	0	3	0	1	57	1	2	0	1	0
189	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	25	1	2	0	1	0
190	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	37	1	2	0	1	0
191	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	25	1	2	0	1	0
192	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	23	1	2	0	1	0
193	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	25	1	2	0	1	0
194	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	23	1	2	0	1	0
195	0	1	1	0	2	0	3	0	0	3	0	0	3	0	1	25	0	2	0	1	0
196	0	1	1	0	2	0	3	0	0	3	0	0	3	0	1	26	0	2	0	1	0
197	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	30	1	2	0	1	0
198	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	35	1	2	0	1	0
199	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	26	1	2	0	1	0
200	0	2	0	1	2	0	2	0	1	3	0	0	1	0	0	55	1	2	0	1	0
201	0	3	0	0	1	1	3	0	0	3	0	0	1	0	0	25	1	2	0	1	0
202	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	53	1	2	0	1	0
203	0	1	1	0	2	0	1	1	0	3	0	0	1	0	0	25	1	2	0	1	0
204	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	43	1	2	0	1	0
205	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	26	1	2	0	1	0
206	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	42	1	2	0	1	0
207	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	34	1	2	0	1	0
208	0	2	0	1	2	0	2	0	1	3	0	0	3	0	1	52	0	2	0	1	0
209	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	29	1	2	0	1	0
210	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	34	1	2	0	1	0
211	0	1	1	0	2	0	2	0	1	3	0	0	3	0	1	31	1	2	0	1	0
212	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	61	1	2	0	1	0
213	0	2	0	1	2	0	2	0	1	3	0	0	1	0	0	60	0	2	0	1	0
214	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	30	1	2	0	1	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
215	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	41	1	2	0	1	0
216	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	51	1	2	0	1	0
217	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	27	1	2	0	1	0
218	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	57	1	2	0	1	0
219	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	37	1	2	0	1	0
220	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	45	1	2	0	1	0
221	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	39	1	2	0	1	0
222	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	43	1	2	0	1	0
223	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	45	1	2	0	1	0
224	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	52	1	2	0	1	0
225	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	37	1	2	0	1	0
226	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	20	1	2	0	1	0
227	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	63	1	2	0	1	0
228	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	33	1	2	0	1	0
229	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	23	1	2	0	1	0
230	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	58	1	2	0	1	0
231	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	39	1	2	0	1	0
232	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	40	1	2	0	1	0
233	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	28	1	2	0	1	0
234	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	51	1	2	0	1	0
235	0	3	0	0	1	1	3	0	0	3	0	0	3	0	1	24	1	2	0	1	0
236	0	1	1	0	2	0	3	0	0	3	0	0	3	0	1	20	1	2	0	1	0
237	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	33	1	2	0	1	0
238	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	44	1	2	0	1	0
239	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	20	1	2	0	1	0
240	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	26	1	2	0	1	0
241	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	56	1	2	0	1	0
242	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	40	1	2	0	1	0
243	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	48	0	2	0	1	0
244	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	43	1	2	0	1	0
245	0	2	0	1	2	0	1	1	0	3	0	0	1	0	0	38	1	2	0	1	0
246	0	3	0	0	1	1	3	0	0	3	0	0	3	0	1	37	1	2	0	1	0
247	0	1	1	0	2	0	3	0	0	3	0	0	2	1	0	59	1	2	0	1	0
248	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	43	1	2	0	1	0
249	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	35	1	2	0	1	0
250	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	52	1	2	0	1	0
251	0	1	1	0	2	0	2	0	1	3	0	0	3	0	1	23	1	2	0	1	0
252	0	3	0	0	2	0	1	1	0	3	0	0	3	0	1	21	1	2	0	1	0
253	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	36	1	2	0	1	0
254	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	57	1	2	0	1	0
255	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	26	1	2	0	1	0
256	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	38	1	2	0	1	0
257	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	54	1	2	0	1	0
258	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	40	0	2	0	1	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
259	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	24	1	2	0	1	0
260	0	1	1	0	2	0	2	0	1	3	0	0	1	0	0	44	1	2	0	1	0
261	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	25	1	2	0	1	0
262	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	21	1	2	0	1	0
263	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	55	1	2	0	1	0
264	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	52	1	2	0	1	0
265	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	32	1	2	0	1	0
266	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	60	1	2	0	1	0
267	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	57	1	2	0	1	0
268	0	1	1	0	2	0	2	0	1	3	0	0	3	0	1	24	1	2	0	1	0
269	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	23	1	2	0	1	0
270	0	1	1	0	2	0	3	0	0	3	0	0	1	0	0	29	1	2	0	1	0
271	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	36	1	2	0	1	0
272	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	53	1	2	0	1	0
273	0	2	0	1	2	0	3	0	0	3	0	0	3	0	1	46	1	2	0	1	0
274	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	27	1	2	0	1	0
275	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	51	1	2	0	1	0
276	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	29	1	2	0	1	0
277	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	58	1	2	0	1	0
278	0	2	0	1	2	0	2	0	1	3	0	0	3	0	1	24	1	2	0	1	0
279	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	49	1	1	1	0	0
280	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	37	1	1	1	0	0
281	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	63	1	1	1	0	0
282	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	62	1	1	1	0	0
283	1	3	0	0	2	0	2	0	1	3	0	0	2	1	0	45	1	1	1	0	0
284	1	1	1	0	2	0	3	0	0	3	0	0	2	1	0	32	1	1	1	0	0
285	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	28	1	1	1	0	0
286	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	30	1	1	1	0	0
287	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	42	1	1	1	0	0
288	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	38	1	1	1	0	0
289	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	35	1	1	1	0	0
290	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	50	1	1	1	0	0
291	1	3	0	0	2	0	3	0	0	3	0	0	3	0	1	27	1	1	1	0	0
292	1	3	0	0	2	0	3	0	0	3	0	0	3	0	1	43	1	1	1	0	0
293	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	46	1	1	1	0	0
294	1	3	0	0	2	0	3	0	0	3	0	0	3	0	1	63	1	1	1	0	0
295	1	3	0	0	2	0	3	0	0	3	0	0	3	0	1	33	1	1	1	0	0
296	1	3	0	0	2	0	3	0	0	3	0	0	3	0	1	42	1	1	1	0	0
297	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	37	1	1	1	0	0
298	1	3	0	0	2	0	3	0	0	3	0	0	3	0	1	61	1	1	1	0	0
299	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	46	1	1	1	0	0
300	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	51	1	1	1	0	0
301	1	1	1	0	2	0	3	0	0	3	0	0	2	1	0	56	1	1	1	0	0
302	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	49	1	1	1	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
303	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	41	1	1	1	0	0
304	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	22	1	1	1	0	0
305	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	30	1	1	1	0	0
306	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	26	1	1	1	0	0
307	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	58	1	1	1	0	0
308	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	42	1	1	1	0	0
309	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	53	1	1	1	0	0
310	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	55	1	1	1	0	0
311	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	39	1	1	1	0	0
312	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	53	1	1	1	0	0
313	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	62	1	1	1	0	0
314	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	55	1	1	1	0	0
315	1	3	0	0	2	0	2	0	1	3	0	0	2	1	0	49	1	1	1	0	0
316	1	1	1	0	2	0	3	0	0	3	0	0	2	1	0	29	1	1	1	0	0
317	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	49	1	1	1	0	0
318	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	32	1	1	1	0	0
319	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	34	0	1	1	0	0
320	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	49	1	1	1	0	0
321	1	3	0	0	2	0	3	0	0	3	0	0	3	0	1	61	1	1	1	0	0
322	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	49	1	1	1	0	0
323	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	63	1	1	1	0	0
324	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	49	1	1	1	0	0
325	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	36	1	1	1	0	0
326	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	60	1	1	1	0	0
327	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	56	1	1	1	0	0
328	1	1	1	0	2	0	3	0	0	3	0	0	1	0	0	70	1	1	1	0	0
329	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	53	1	1	1	0	0
330	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	51	1	1	1	0	0
331	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	37	1	1	1	0	0
332	1	1	1	0	2	0	3	0	0	3	0	0	2	1	0	66	1	1	1	0	0
333	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	57	1	1	1	0	0
334	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	46	1	1	1	0	0
335	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	32	1	1	1	0	0
336	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	39	1	1	1	0	0
337	1	3	0	0	2	0	2	0	1	3	0	0	1	0	0	54	1	1	1	0	0
338	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	57	1	1	1	0	0
339	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	37	1	1	1	0	0
340	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	45	1	1	1	0	0
341	1	3	0	0	2	0	2	0	1	3	0	0	2	1	0	54	1	1	1	0	0
342	1	3	0	0	2	0	3	0	0	3	0	0	3	0	1	45	1	1	1	0	0
343	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	60	1	1	1	0	0
344	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	31	1	1	1	0	0
345	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	61	1	1	1	0	0
346	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	54	1	1	1	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
347	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	46	1	1	1	0	0
348	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	56	1	1	1	0	0
349	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	32	1	1	1	0	0
350	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	48	1	1	1	0	0
351	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	32	1	1	1	0	0
352	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	53	1	1	1	0	0
353	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	58	1	1	1	0	0
354	1	3	0	0	2	0	1	1	0	3	0	0	2	1	0	45	1	1	1	0	0
355	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	44	1	1	1	0	0
356	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	35	1	1	1	0	0
357	1	1	1	0	2	0	3	0	0	3	0	0	2	1	0	46	1	1	1	0	0
358	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	53	1	1	1	0	0
359	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	34	1	1	1	0	0
360	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	49	1	1	1	0	0
361	1	3	0	0	2	0	3	0	0	3	0	0	2	1	0	54	1	1	1	0	0
362	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	40	1	1	1	0	0
363	1	3	0	0	2	0	3	0	0	3	0	0	1	0	0	48	1	1	1	0	0
364	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	60	1	1	1	0	0
365	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	58	1	1	1	0	0
366	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	47	1	1	1	0	0
367	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	38	1	1	1	0	0
368	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	40	1	1	1	0	0
369	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	49	1	1	1	0	0
370	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	54	1	1	1	0	0
371	0	1	1	0	2	0	3	0	0	3	0	0	1	0	0	48	1	1	1	0	0
372	0	1	1	0	2	0	2	0	1	3	0	0	1	0	0	28	1	1	1	0	0
373	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	46	1	1	1	0	0
374	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	44	1	1	1	0	0
375	0	1	1	0	2	0	3	0	0	3	0	0	1	0	0	52	1	1	1	0	0
376	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	54	1	1	1	0	0
377	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	30	1	1	1	0	0
378	0	3	0	0	2	0	1	1	0	3	0	0	3	0	1	40	1	1	1	0	0
379	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	54	1	1	1	0	0
380	0	1	1	0	2	0	1	1	0	3	0	0	2	1	0	36	1	1	1	0	0
381	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	28	1	1	1	0	0
382	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	42	1	1	1	0	0
383	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	36	1	1	1	0	0
384	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	49	1	1	1	0	0
385	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	51	1	1	1	0	0
386	0	2	0	1	2	0	2	0	1	3	0	0	1	0	0	33	1	1	1	0	0
387	0	2	0	1	2	0	2	0	1	3	0	0	1	0	0	55	1	1	1	0	0
388	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	54	1	1	1	0	0
389	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	56	1	1	1	0	0
390	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	22	0	1	1	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
391	0	3	0	0	1	1	3	0	0	3	0	0	1	0	0	36	1	1	1	0	0
392	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	55	1	1	1	0	0
393	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	36	1	1	1	0	0
394	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	66	1	1	1	0	0
395	0	1	1	0	2	0	2	0	1	3	0	0	3	0	1	35	0	1	1	0	0
396	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	58	1	1	1	0	0
397	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	43	1	1	1	0	0
398	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	60	0	1	1	0	0
399	0	3	0	0	1	1	3	0	0	3	0	0	3	0	1	42	1	1	1	0	0
400	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	39	1	1	1	0	0
401	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	61	1	1	1	0	0
402	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	39	1	1	1	0	0
403	0	1	1	0	2	0	2	0	1	3	0	0	3	0	1	55	0	1	1	0	0
404	0	1	1	0	2	0	2	0	1	3	0	0	1	0	0	44	1	1	1	0	0
405	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	57	1	1	1	0	0
406	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	57	1	1	1	0	0
407	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	24	1	1	1	0	0
408	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	51	1	1	1	0	0
409	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	38	1	1	1	0	0
410	0	1	1	0	2	0	1	1	0	3	0	0	2	1	0	39	1	1	1	0	0
411	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	47	1	1	1	0	0
412	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	43	1	1	1	0	0
413	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	36	1	1	1	0	0
414	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	30	1	1	1	0	0
415	0	3	0	0	2	0	1	1	0	3	0	0	3	0	1	52	1	1	1	0	0
416	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	56	0	1	1	0	0
417	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	62	1	1	1	0	0
418	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	55	1	1	1	0	0
419	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	50	1	1	1	0	0
420	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	49	1	1	1	0	0
421	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	56	1	1	1	0	0
422	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	55	1	1	1	0	0
423	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	37	1	1	1	0	0
424	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	59	1	1	1	0	0
425	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	51	1	1	1	0	0
426	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	41	1	1	1	0	0
427	0	2	0	1	2	0	2	0	1	3	0	0	3	0	1	43	0	1	1	0	0
428	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	54	1	1	1	0	0
429	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	56	1	1	1	0	0
430	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	52	1	1	1	0	0
431	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	51	1	1	1	0	0
432	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	47	1	1	1	0	0
433	0	2	0	1	2	0	2	0	1	3	0	0	1	0	0	55	1	1	1	0	0
434	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	62	1	1	1	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
435	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	59	1	1	1	0	0
436	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	58	1	1	1	0	0
437	0	3	0	0	2	0	1	1	0	3	0	0	3	0	1	50	0	1	1	0	0
438	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	27	1	1	1	0	0
439	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	32	1	1	1	0	0
440	0	1	1	0	2	0	1	1	0	3	0	0	1	0	0	55	1	1	1	0	0
441	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	28	1	1	1	0	0
442	0	3	0	0	2	0	1	1	0	3	0	0	3	0	1	42	1	1	1	0	0
443	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	42	1	1	1	0	0
444	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	56	1	1	1	0	0
445	0	1	1	0	2	0	2	0	1	3	0	0	3	0	1	34	0	1	1	0	0
446	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	59	1	1	1	0	0
447	0	3	0	0	1	1	3	0	0	3	0	0	2	1	0	34	1	1	1	0	0
448	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	43	1	1	1	0	0
449	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	24	1	1	1	0	0
450	0	3	0	0	2	0	1	1	0	3	0	0	3	0	1	35	1	1	1	0	0
451	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	43	1	1	1	0	0
452	0	1	1	0	2	0	1	1	0	3	0	0	2	1	0	25	1	1	1	0	0
453	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	60	1	1	1	0	0
454	0	2	0	1	2	0	3	0	0	3	0	0	3	0	1	51	1	1	1	0	0
455	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	55	1	1	1	0	0
456	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	61	1	1	1	0	0
457	0	1	1	0	2	0	2	0	1	3	0	0	1	0	0	44	1	1	1	0	0
458	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	55	1	1	1	0	0
459	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	38	1	1	1	0	0
460	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	46	1	1	1	0	0
461	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	65	1	1	1	0	0
462	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	58	1	1	1	0	0
463	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	52	1	1	1	0	0
464	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	37	1	1	1	0	0
465	0	3	0	0	2	0	1	1	0	3	0	0	3	0	1	48	1	1	1	0	0
466	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	55	1	1	1	0	0
467	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	62	1	1	1	0	0
468	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	42	1	1	1	0	0
469	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	58	1	1	1	0	0
470	0	2	0	1	1	1	3	0	0	3	0	0	1	0	0	21	0	1	1	0	0
471	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	39	1	1	1	0	0
472	0	2	0	1	2	0	2	0	1	3	0	0	1	0	0	50	1	1	1	0	0
473	0	2	0	1	2	0	3	0	0	3	0	0	3	0	1	45	0	1	1	0	0
474	0	1	1	0	2	0	2	0	1	3	0	0	3	0	1	24	1	1	1	0	0
475	0	2	0	1	2	0	2	0	1	3	0	0	3	0	1	45	0	1	1	0	0
476	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	34	1	1	1	0	0
477	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	64	0	1	1	0	0
478	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	42	1	1	1	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
479	0	1	1	0	2	0	3	0	0	3	0	0	2	1	0	25	1	1	1	0	0
480	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	40	1	1	1	0	0
481	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	38	1	1	1	0	0
482	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	64	1	1	1	0	0
483	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	21	1	1	1	0	0
484	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	48	0	1	1	0	0
485	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	32	1	1	1	0	0
486	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	39	1	1	1	0	0
487	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	48	1	1	1	0	0
488	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	29	1	1	1	0	0
489	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	35	1	1	1	0	0
490	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	20	1	1	1	0	0
491	0	1	1	0	2	0	2	0	1	3	0	0	3	0	1	35	0	1	1	0	0
492	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	60	1	1	1	0	0
493	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	48	1	1	1	0	0
494	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	31	1	1	1	0	0
495	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	47	1	1	1	0	0
496	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	45	1	1	1	0	0
497	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	33	1	1	1	0	0
498	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	52	1	1	1	0	0
499	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	38	1	1	1	0	0
500	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	28	1	1	1	0	0
501	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	42	1	1	1	0	0
502	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	58	1	1	1	0	0
503	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	49	1	1	1	0	0
504	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	48	1	1	1	0	0
505	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	56	1	1	1	0	0
506	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	26	1	1	1	0	0
507	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	57	1	1	1	0	0
508	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	39	1	1	1	0	0
509	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	40	1	1	1	0	0
510	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	39	1	1	1	0	0
511	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	52	1	1	1	0	0
512	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	34	1	1	1	0	0
513	0	2	0	1	2	0	1	1	0	3	0	0	1	0	0	42	0	1	1	0	0
514	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	48	1	1	1	0	0
515	0	1	1	0	2	0	2	0	1	3	0	0	3	0	1	53	1	1	1	0	0
516	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	42	1	1	1	0	0
517	0	1	1	0	2	0	3	0	0	3	0	0	1	0	0	53	1	1	1	0	0
518	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	54	1	1	1	0	0
519	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	44	1	1	1	0	0
520	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	40	1	1	1	0	0
521	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	27	1	1	1	0	0
522	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	36	1	1	1	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
523	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	48	1	1	1	0	0
524	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	29	1	1	1	0	0
525	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	52	1	1	1	0	0
526	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	47	1	1	1	0	0
527	0	2	0	1	2	0	2	0	1	3	0	0	1	0	0	27	1	1	1	0	0
528	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	52	1	1	1	0	0
529	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	60	1	1	1	0	0
530	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	44	1	1	1	0	0
531	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	50	1	1	1	0	0
532	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	41	1	1	1	0	0
533	0	2	0	1	2	0	2	0	1	3	0	0	1	0	0	42	0	1	1	0	0
534	0	2	0	1	2	0	1	1	0	3	0	0	2	1	0	54	0	1	1	0	0
535	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	54	1	1	1	0	0
536	0	1	1	0	2	0	2	0	1	3	0	0	1	0	0	44	1	1	1	0	0
537	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	35	1	1	1	0	0
538	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	42	1	1	1	0	0
539	0	1	1	0	2	0	3	0	0	3	0	0	1	0	0	52	1	1	1	0	0
540	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	31	1	1	1	0	0
541	0	3	0	0	2	0	1	1	0	3	0	0	3	0	1	50	1	1	1	0	0
542	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	89	0	1	1	0	0
543	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	63	1	1	1	0	0
544	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	46	1	1	1	0	0
545	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	32	1	1	1	0	0
546	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	62	1	1	1	0	0
547	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	48	1	1	1	0	0
548	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	33	1	1	1	0	0
549	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	33	1	1	1	0	0
550	0	1	1	0	2	0	3	0	0	3	0	0	2	1	0	48	1	1	1	0	0
551	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	25	1	1	1	0	0
552	0	1	1	0	2	0	2	0	1	3	0	0	1	0	0	45	1	1	1	0	0
553	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	43	1	1	1	0	0
554	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	50	1	1	1	0	0
555	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	60	1	1	1	0	0
556	0	3	0	0	2	0	1	1	0	3	0	0	3	0	1	43	0	1	1	0	0
557	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	40	0	1	1	0	0
558	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	50	1	1	1	0	0
559	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	47	1	1	1	0	0
560	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	60	1	1	1	0	0
561	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	45	1	1	1	0	0
562	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	46	1	1	1	0	0
563	0	3	0	0	1	1	2	0	1	3	0	0	2	1	0	48	1	1	1	0	0
564	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	37	1	1	1	0	0
565	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	59	1	1	1	0	0
566	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	35	1	1	1	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
567	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	51	1	1	1	0	0
568	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	49	1	1	1	0	0
569	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	62	1	1	1	0	0
570	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	49	1	1	1	0	0
571	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	47	1	1	1	0	0
572	0	2	0	1	2	0	3	0	0	3	0	0	2	1	0	41	1	1	1	0	0
573	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	24	1	1	1	0	0
574	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	57	1	1	1	0	0
575	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	44	1	1	1	0	0
576	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	56	1	1	1	0	0
577	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	53	1	1	1	0	0
578	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	58	0	1	1	0	0
579	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	34	1	1	1	0	0
580	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	35	1	1	1	0	0
581	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	22	1	1	1	0	0
582	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	53	1	1	1	0	0
583	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	48	1	1	1	0	0
584	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	54	1	1	1	0	0
585	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	63	1	1	1	0	0
586	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	45	1	1	1	0	0
587	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	35	1	1	1	0	0
588	0	1	1	0	2	0	1	1	0	3	0	0	3	0	1	54	0	1	1	0	0
589	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	37	1	1	1	0	0
590	0	2	0	1	2	0	3	0	0	3	0	0	1	0	0	41	0	1	1	0	0
591	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	54	1	1	1	0	0
592	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	50	1	1	1	0	0
593	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	49	1	1	1	0	0
594	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	50	1	1	1	0	0
595	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	60	1	1	1	0	0
596	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	50	1	1	1	0	0
597	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	45	1	1	1	0	0
598	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	51	1	1	1	0	0
599	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	65	1	1	1	0	0
600	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	39	1	1	1	0	0
601	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	48	1	1	1	0	0
602	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	18	1	1	1	0	0
603	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	46	1	1	1	0	0
604	0	2	0	1	2	0	2	0	1	3	0	0	2	1	0	28	1	1	1	0	0
605	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	54	1	1	1	0	0
606	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	33	1	1	1	0	0
607	0	1	1	0	2	0	2	0	1	3	0	0	1	0	0	54	1	1	1	0	0
608	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	49	1	1	1	0	0
609	0	3	0	0	2	0	1	1	0	3	0	0	3	0	1	61	1	1	1	0	0
610	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	28	1	1	1	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
611	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	45	1	1	1	0	0
612	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	28	1	1	1	0	0
613	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	43	1	1	1	0	0
614	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	29	1	1	1	0	0
615	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	42	1	1	1	0	0
616	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	53	1	1	1	0	0
617	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	37	0	1	1	0	0
618	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	33	1	1	1	0	0
619	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	26	1	1	1	0	0
620	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	48	1	1	1	0	0
621	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	53	1	1	1	0	0
622	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	38	1	1	1	0	0
623	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	54	1	1	1	0	0
624	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	53	1	1	1	0	0
625	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	49	1	1	1	0	0
626	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	57	1	1	1	0	0
627	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	56	1	1	1	0	0
628	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	53	1	1	1	0	0
629	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	57	1	1	1	0	0
630	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	46	1	1	1	0	0
631	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	55	1	1	1	0	0
632	0	2	0	1	2	0	3	0	0	3	0	0	1	0	0	59	0	1	1	0	0
633	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	45	1	1	1	0	0
634	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	40	1	1	1	0	0
635	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	52	1	1	1	0	0
636	0	3	0	0	2	0	1	1	0	3	0	0	3	0	1	56	1	1	1	0	0
637	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	53	1	1	1	0	0
638	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	20	1	1	1	0	0
639	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	52	1	1	1	0	0
640	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	49	1	1	1	0	0
641	0	2	0	1	2	0	1	1	0	3	0	0	2	1	0	48	0	1	1	0	0
642	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	50	1	1	1	0	0
643	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	62	1	1	1	0	0
644	0	2	0	1	2	0	2	0	1	3	0	0	1	0	0	19	1	1	1	0	0
645	0	1	1	0	2	0	2	0	1	3	0	0	1	0	0	33	1	1	1	0	0
646	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	28	1	1	1	0	0
647	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	47	1	1	1	0	0
648	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	64	1	1	1	0	0
649	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	37	1	1	1	0	0
650	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	28	0	1	1	0	0
651	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	53	1	1	1	0	0
652	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	51	1	1	1	0	0
653	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	38	1	1	1	0	0
654	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	34	1	1	1	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
655	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	35	1	1	1	0	0
656	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	38	1	1	1	0	0
657	0	1	1	0	2	0	2	0	1	3	0	0	2	1	0	42	0	1	1	0	0
658	0	2	0	1	2	0	2	0	1	3	0	0	3	0	1	52	0	1	1	0	0
659	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	53	1	1	1	0	0
660	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	54	1	1	1	0	0
661	0	1	1	0	2	0	3	0	0	3	0	0	2	1	0	45	1	1	1	0	0
662	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	42	1	1	1	0	0
663	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	62	1	1	1	0	0
664	0	3	0	0	2	0	1	1	0	3	0	0	1	0	0	29	1	1	1	0	0
665	0	2	0	1	2	0	2	0	1	3	0	0	2	1	0	64	1	1	1	0	0
666	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	49	1	1	1	0	0
667	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	59	1	1	1	0	0
668	0	3	0	0	2	0	2	0	1	3	0	0	3	0	1	51	0	1	1	0	0
669	0	3	0	0	1	1	3	0	0	3	0	0	1	0	0	43	1	1	1	0	0
670	0	3	0	0	1	1	3	0	0	3	0	0	1	0	0	43	1	1	1	0	0
671	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	33	0	1	1	0	0
672	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	52	1	1	1	0	0
673	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	45	1	1	1	0	0
674	0	3	0	0	2	0	3	0	0	3	0	0	1	0	0	45	1	1	1	0	0
675	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	32	1	1	1	0	0
676	0	3	0	0	2	0	3	0	0	3	0	0	3	0	1	32	1	1	1	0	0
677	0	3	0	0	2	0	2	0	1	3	0	0	2	1	0	52	1	1	1	0	0
678	0	3	0	0	2	0	1	1	0	3	0	0	2	1	0	53	1	1	1	0	0
679	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	56	1	1	1	0	0
680	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	48	1	1	1	0	0
681	0	3	0	0	2	0	2	0	1	3	0	0	1	0	0	64	1	1	1	0	0
682	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	37	1	1	1	0	0
683	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	46	1	1	1	0	0
684	0	3	0	0	2	0	3	0	0	3	0	0	2	1	0	57	1	1	1	0	0
685	0	3	0	0	2	0	3	0	0	2	0	1	1	0	0	41	1	4	0	0	0
686	0	3	0	0	2	0	2	0	1	2	0	1	1	0	0	40	1	4	0	0	0
687	1	3	0	0	2	0	3	0	0	2	0	1	2	1	0	30	1	2	0	1	0
688	1	1	1	0	2	0	3	0	0	2	0	1	2	1	0	28	1	2	0	1	0
689	1	3	0	0	2	0	3	0	0	2	0	1	2	1	0	33	1	2	0	1	0
690	1	1	1	0	2	0	3	0	0	2	0	1	2	1	0	42	0	2	0	1	0
691	0	2	0	1	2	0	2	0	1	2	0	1	3	0	1	33	0	2	0	1	0
692	0	1	1	0	2	0	2	0	1	2	0	1	2	1	0	22	1	2	0	1	0
693	0	2	0	1	2	0	1	1	0	2	0	1	2	1	0	23	1	2	0	1	0
694	0	3	0	0	2	0	2	0	1	2	0	1	3	0	1	36	0	2	0	1	0
695	0	3	0	0	2	0	3	0	0	2	0	1	1	0	0	33	1	2	0	1	0
696	0	3	0	0	2	0	2	0	1	2	0	1	1	0	0	23	1	2	0	1	0
697	0	3	0	0	2	0	3	0	0	2	0	1	1	0	0	32	1	2	0	1	0
698	0	3	0	0	2	0	2	0	1	2	0	1	2	1	0	25	1	2	0	1	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
699	0	1	1	0	2	0	2	0	1	2	0	1	2	1	0	27	0	2	0	1	0
700	0	1	1	0	2	0	2	0	1	2	0	1	2	1	0	49	1	2	0	1	0
701	0	3	0	0	2	0	2	0	1	2	0	1	3	0	1	28	0	2	0	1	0
702	0	1	1	0	2	0	1	1	0	2	0	1	2	1	0	52	0	2	0	1	0
703	0	3	0	0	2	0	2	0	1	2	0	1	1	0	0	34	1	2	0	1	0
704	0	2	0	1	2	0	2	0	1	2	0	1	3	0	1	22	0	2	0	1	0
705	0	3	0	0	2	0	3	0	0	2	0	1	2	1	0	24	0	2	0	1	0
706	0	3	0	0	2	0	3	0	0	2	0	1	2	1	0	42	1	2	0	1	0
707	0	1	1	0	2	0	2	0	1	2	0	1	2	1	0	25	1	2	0	1	0
708	0	3	0	0	2	0	3	0	0	2	0	1	2	1	0	39	1	2	0	1	0
709	0	2	0	1	2	0	3	0	0	2	0	1	3	0	1	25	0	2	0	1	0
710	0	1	1	0	2	0	2	0	1	2	0	1	2	1	0	44	0	2	0	1	0
711	0	1	1	0	2	0	2	0	1	2	0	1	2	1	0	25	1	2	0	1	0
712	0	3	0	0	2	0	2	0	1	2	0	1	2	1	0	32	1	2	0	1	0
713	0	3	0	0	2	0	2	0	1	2	0	1	2	1	0	59	0	2	0	1	0
714	0	3	0	0	2	0	3	0	0	2	0	1	2	1	0	40	1	2	0	1	0
715	0	3	0	0	2	0	2	0	1	2	0	1	1	0	0	31	1	2	0	1	0
716	1	3	0	0	2	0	1	1	0	2	0	1	1	0	0	40	1	1	1	0	0
717	1	3	0	0	2	0	3	0	0	2	0	1	1	0	0	28	1	1	1	0	0
718	1	3	0	0	2	0	3	0	0	2	0	1	2	1	0	66	0	1	1	0	0
719	1	3	0	0	2	0	3	0	0	2	0	1	2	1	0	44	0	1	1	0	0
720	1	3	0	0	2	0	2	0	1	2	0	1	1	0	0	32	1	1	1	0	0
721	1	3	0	0	2	0	3	0	0	2	0	1	1	0	0	51	0	1	1	0	0
722	1	3	0	0	2	0	2	0	1	2	0	1	1	0	0	39	1	1	1	0	0
723	1	1	1	0	2	0	3	0	0	2	0	1	2	1	0	26	1	1	1	0	0
724	1	3	0	0	2	0	3	0	0	2	0	1	3	0	1	37	0	1	1	0	0
725	1	3	0	0	2	0	2	0	1	2	0	1	1	0	0	70	1	1	1	0	0
726	0	3	0	0	2	0	3	0	0	2	0	1	3	0	1	53	0	1	1	0	0
727	0	2	0	1	2	0	1	1	0	2	0	1	2	1	0	46	1	1	1	0	0
728	0	1	1	0	2	0	3	0	0	2	0	1	2	1	0	32	0	1	1	0	0
729	0	1	1	0	2	0	1	1	0	2	0	1	2	1	0	53	1	1	1	0	0
730	0	1	1	0	2	0	3	0	0	2	0	1	1	0	0	38	1	1	1	0	0
731	0	2	0	1	2	0	1	1	0	2	0	1	1	0	0	52	1	1	1	0	0
732	0	1	1	0	2	0	3	0	0	2	0	1	2	1	0	46	1	1	1	0	0
733	0	1	1	0	2	0	1	1	0	2	0	1	3	0	1	32	0	1	1	0	0
734	0	1	1	0	2	0	2	0	1	2	0	1	1	0	0	46	0	1	1	0	0
735	0	2	0	1	2	0	2	0	1	2	0	1	3	0	1	34	0	1	1	0	0
736	0	3	0	0	2	0	3	0	0	2	0	1	1	0	0	45	1	1	1	0	0
737	0	3	0	0	2	0	2	0	1	2	0	1	3	0	1	52	0	1	1	0	0
738	0	3	0	0	2	0	2	0	1	2	0	1	3	0	1	63	0	1	1	0	0
739	0	3	0	0	2	0	2	0	1	2	0	1	1	0	0	32	1	1	1	0	0
740	0	1	1	0	2	0	3	0	0	2	0	1	2	1	0	28	1	1	1	0	0
741	0	1	1	0	2	0	2	0	1	2	0	1	1	0	0	30	1	1	1	0	0
742	0	2	0	1	2	0	1	1	0	2	0	1	1	0	0	44	1	1	1	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
743	0	3	0	0	2	0	3	0	0	2	0	1	3	0	1	48	0	1	1	0	0
744	0	2	0	1	2	0	2	0	1	2	0	1	2	1	0	50	1	1	1	0	0
745	0	2	0	1	2	0	2	0	1	2	0	1	3	0	1	41	1	1	1	0	0
746	0	3	0	0	2	0	2	0	1	2	0	1	3	0	1	28	1	1	1	0	0
747	0	3	0	0	2	0	3	0	0	2	0	1	1	0	0	34	1	1	1	0	0
748	0	2	0	1	2	0	2	0	1	2	0	1	3	0	1	59	0	1	1	0	0
749	0	3	0	0	2	0	3	0	0	2	0	1	2	1	0	38	1	1	1	0	0
750	0	2	0	1	2	0	2	0	1	2	0	1	2	1	0	35	1	1	1	0	0
751	0	2	0	1	2	0	2	0	1	2	0	1	3	0	1	40	0	1	1	0	0
752	0	1	1	0	2	0	2	0	1	2	0	1	3	0	1	28	1	1	1	0	0
753	0	2	0	1	2	0	2	0	1	2	0	1	3	0	1	40	1	1	1	0	0
754	0	3	0	0	2	0	2	0	1	2	0	1	2	1	0	41	1	1	1	0	0
755	0	2	0	1	2	0	2	0	1	2	0	1	3	0	1	33	0	1	1	0	0
756	0	1	1	0	2	0	2	0	1	2	0	1	1	0	0	34	1	1	1	0	0
757	0	1	1	0	2	0	1	1	0	2	0	1	1	0	0	50	0	1	1	0	0
758	0	3	0	0	2	0	1	1	0	2	0	1	1	0	0	46	1	1	1	0	0
759	0	2	0	1	2	0	1	1	0	2	0	1	3	0	1	39	1	1	1	0	0
760	0	2	0	1	2	0	2	0	1	2	0	1	3	0	1	36	0	1	1	0	0
761	0	1	1	0	2	0	3	0	0	2	0	1	1	0	0	59	1	1	1	0	0
762	0	1	1	0	2	0	2	0	1	2	0	1	2	1	0	31	1	1	1	0	0
763	0	3	0	0	2	0	2	0	1	2	0	1	2	1	0	38	1	1	1	0	0
764	0	3	0	0	2	0	2	0	1	2	0	1	1	0	0	52	1	1	1	0	0
765	0	3	0	0	2	0	1	1	0	2	0	1	2	1	0	46	1	1	1	0	0
766	0	1	1	0	2	0	2	0	1	2	0	1	2	1	0	43	1	1	1	0	0
767	0	3	0	0	2	0	3	0	0	2	0	1	1	0	0	27	1	1	1	0	0
768	0	3	0	0	2	0	3	0	0	2	0	1	1	0	0	25	1	1	1	0	0
769	0	3	0	0	2	0	2	0	1	2	0	1	3	0	1	48	0	1	1	0	0
770	0	1	1	0	1	1	3	0	0	2	0	1	1	0	0	29	1	1	1	0	0
771	0	2	0	1	2	0	2	0	1	2	0	1	3	0	1	31	0	1	1	0	0
772	0	3	0	0	2	0	3	0	0	2	0	1	2	1	0	61	0	1	1	0	0
773	0	2	0	1	2	0	2	0	1	2	0	1	2	1	0	37	0	1	1	0	0
774	0	1	1	0	2	0	3	0	0	2	0	1	1	0	0	37	1	1	1	0	0
775	0	1	1	0	2	0	2	0	1	2	0	1	2	1	0	59	1	1	1	0	0
776	0	1	1	0	2	0	3	0	0	2	0	1	2	1	0	45	1	1	1	0	0
777	0	1	1	0	2	0	3	0	0	2	0	1	3	0	1	55	1	1	1	0	0
778	0	1	1	0	2	0	3	0	0	2	0	1	2	1	0	57	1	1	1	0	0
779	0	1	1	0	2	0	2	0	1	2	0	1	2	1	0	40	1	1	1	0	0
780	0	1	1	0	2	0	2	0	1	2	0	1	2	1	0	55	0	1	1	0	0
781	0	3	0	0	2	0	2	0	1	2	0	1	1	0	0	33	1	1	1	0	0
782	0	1	1	0	2	0	2	0	1	2	0	1	1	0	0	51	1	1	1	0	0
783	0	3	0	0	2	0	3	0	0	2	0	1	1	0	0	61	1	1	1	0	0
784	0	2	0	1	2	0	2	0	1	2	0	1	3	0	1	60	0	1	1	0	0
785	0	2	0	1	2	0	2	0	1	2	0	1	3	0	1	40	0	1	1	0	0
786	0	1	1	0	2	0	2	0	1	2	0	1	1	0	0	50	1	1	1	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
787	0	3	0	0	2	0	3	0	0	2	0	1	2	1	0	37	1	1	1	0	0
788	0	3	0	0	2	0	1	1	0	2	0	1	2	1	0	53	1	1	1	0	0
789	0	1	1	0	2	0	2	0	1	2	0	1	2	1	0	41	0	1	1	0	0
790	0	3	0	0	2	0	3	0	0	2	0	1	1	0	0	35	1	1	1	0	0
791	0	1	1	0	2	0	2	0	1	2	0	1	1	0	0	54	1	1	1	0	0
792	0	3	0	0	2	0	3	0	0	2	0	1	1	0	0	44	1	1	1	0	0
793	0	1	1	0	2	0	3	0	0	2	0	1	1	0	0	44	1	1	1	0	0
794	0	2	0	1	2	0	3	0	0	2	0	1	2	1	0	42	1	1	1	0	0
795	0	2	0	1	2	0	2	0	1	2	0	1	3	0	1	34	0	1	1	0	0
796	1	1	1	0	2	0	3	0	0	1	1	0	2	1	0	66	1	4	0	0	0
797	1	3	0	0	2	0	3	0	0	1	1	0	2	1	0	58	1	4	0	0	0
798	1	3	0	0	2	0	3	0	0	1	1	0	1	0	0	58	1	4	0	0	0
799	1	1	1	0	2	0	3	0	0	1	1	0	1	0	0	40	1	4	0	0	0
800	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	58	1	4	0	0	0
801	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	39	1	4	0	0	0
802	0	3	0	0	2	0	1	1	0	1	1	0	1	0	0	19	1	4	0	0	0
803	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	22	1	4	0	0	0
804	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	17	1	4	0	0	0
805	0	3	0	0	1	1	3	0	0	1	1	0	1	0	0	29	1	4	0	0	0
806	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	37	1	4	0	0	0
807	0	1	1	0	2	0	3	0	0	1	1	0	1	0	0	68	1	4	0	0	0
808	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	16	1	4	0	0	0
809	0	3	0	0	2	0	3	0	0	1	1	0	1	0	0	29	1	4	0	0	0
810	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	25	1	4	0	0	0
811	1	1	1	0	2	0	3	0	0	1	1	0	2	1	0	38	1	2	0	1	0
812	1	1	1	0	2	0	3	0	0	1	1	0	1	0	0	48	1	2	0	1	0
813	1	1	1	0	2	0	3	0	0	1	1	0	1	0	0	29	1	2	0	1	0
814	1	3	0	0	2	0	3	0	0	1	1	0	1	0	0	53	1	2	0	1	0
815	1	3	0	0	2	0	3	0	0	1	1	0	2	1	0	37	1	2	0	1	0
816	1	3	0	0	2	0	3	0	0	1	1	0	1	0	0	56	1	2	0	1	0
817	1	3	0	0	2	0	2	0	1	1	1	0	1	0	0	55	1	2	0	1	0
818	1	3	0	0	2	0	3	0	0	1	1	0	1	0	0	41	1	2	0	1	0
819	1	1	1	0	2	0	2	0	1	1	1	0	1	0	0	53	1	2	0	1	0
820	1	3	0	0	2	0	3	0	0	1	1	0	1	0	0	43	1	2	0	1	0
821	1	1	1	0	2	0	3	0	0	1	1	0	2	1	0	22	1	2	0	1	0
822	1	1	1	0	2	0	3	0	0	1	1	0	2	1	0	37	1	2	0	1	0
823	1	3	0	0	2	0	2	0	1	1	1	0	2	1	0	57	1	2	0	1	0
824	1	1	1	0	2	0	3	0	0	1	1	0	2	1	0	35	1	2	0	1	0
825	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	54	0	2	0	1	0
826	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	58	1	2	0	1	0
827	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	43	0	2	0	1	0
828	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	19	1	2	0	1	0
829	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	22	0	2	0	1	0
830	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	48	1	2	0	1	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
831	0	3	0	0	2	0	3	0	0	1	1	0	2	1	0	41	1	2	0	1	0
832	0	3	0	0	2	0	2	0	1	1	1	0	1	0	0	40	1	2	0	1	0
833	0	1	1	0	2	0	3	0	0	1	1	0	3	0	1	22	1	2	0	1	0
834	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	27	0	2	0	1	0
835	0	3	0	0	2	0	2	0	1	1	1	0	1	0	0	51	1	2	0	1	0
836	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	29	1	2	0	1	0
837	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	37	1	2	0	1	0
838	0	3	0	0	2	0	3	0	0	1	1	0	2	1	0	47	1	2	0	1	0
839	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	37	1	2	0	1	0
840	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	40	1	2	0	1	0
841	0	1	1	0	2	0	3	0	0	1	1	0	1	0	0	32	1	2	0	1	0
842	0	3	0	0	2	0	2	0	1	1	1	0	1	0	0	34	0	2	0	1	0
843	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	22	1	2	0	1	0
844	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	30	1	2	0	1	0
845	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	41	1	2	0	1	0
846	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	38	1	2	0	1	0
847	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	32	1	2	0	1	0
848	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	38	1	2	0	1	0
849	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	20	1	2	0	1	0
850	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	36	1	2	0	1	0
851	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	25	0	2	0	1	0
852	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	21	1	2	0	1	0
853	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	20	1	2	0	1	0
854	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	29	1	2	0	1	0
855	0	1	1	0	2	0	3	0	0	1	1	0	3	0	1	23	1	2	0	1	0
856	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	21	0	2	0	1	0
857	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	53	0	2	0	1	0
858	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	20	1	2	0	1	0
859	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	29	1	2	0	1	0
860	0	1	1	0	1	1	3	0	0	1	1	0	2	1	0	24	0	2	0	1	0
861	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	62	1	2	0	1	0
862	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	33	0	2	0	1	0
863	0	3	0	0	2	0	2	0	1	1	1	0	1	0	0	36	1	2	0	1	0
864	0	3	0	0	1	1	3	0	0	1	1	0	2	1	0	46	1	2	0	1	0
865	0	3	0	0	1	1	3	0	0	1	1	0	2	1	0	43	1	2	0	1	0
866	0	3	0	0	1	1	3	0	0	1	1	0	2	1	0	27	1	2	0	1	0
867	0	3	0	0	1	1	3	0	0	1	1	0	2	1	0	38	1	2	0	1	0
868	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	57	1	2	0	1	0
869	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	41	1	2	0	1	0
870	0	3	0	0	2	0	2	0	1	1	1	0	1	0	0	33	1	2	0	1	0
871	0	3	0	0	2	0	2	0	1	1	1	0	1	0	0	47	1	2	0	1	0
872	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	51	1	2	0	1	0
873	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	33	1	2	0	1	0
874	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	48	1	2	0	1	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
875	0	3	0	0	2	0	3	0	0	1	1	0	2	1	0	34	1	2	0	1	0
876	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	44	1	2	0	1	0
877	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	19	1	2	0	1	0
878	0	3	0	0	2	0	2	0	1	1	1	0	1	0	0	56	1	2	0	1	0
879	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	39	1	2	0	1	0
880	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	38	0	2	0	1	0
881	0	1	1	0	1	1	3	0	0	1	1	0	2	1	0	19	0	2	0	1	0
882	0	3	0	0	2	0	1	1	0	1	1	0	1	0	0	37	1	2	0	1	0
883	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	41	1	2	0	1	0
884	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	22	1	2	0	1	0
885	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	19	1	2	0	1	0
886	0	3	0	0	2	0	2	0	1	1	1	0	1	0	0	33	1	2	0	1	0
887	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	42	1	2	0	1	0
888	0	1	1	0	1	1	1	1	0	1	1	0	2	1	0	60	1	2	0	1	0
889	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	26	1	2	0	1	0
890	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	20	1	2	0	1	0
891	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	29	1	2	0	1	0
892	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	20	1	2	0	1	0
893	0	1	1	0	1	1	3	0	0	1	1	0	3	0	1	29	0	2	0	1	0
894	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	30	1	2	0	1	0
895	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	40	1	2	0	1	0
896	1	3	0	0	2	0	1	1	0	1	1	0	1	0	0	70	1	1	1	0	0
897	1	1	1	0	2	0	3	0	0	1	1	0	2	1	0	62	1	1	1	0	0
898	1	1	1	0	2	0	3	0	0	1	1	0	2	1	0	45	1	1	1	0	0
899	1	1	1	0	2	0	3	0	0	1	1	0	2	1	0	29	1	1	1	0	0
900	1	1	1	0	2	0	3	0	0	1	1	0	2	1	0	28	1	1	1	0	0
901	1	1	1	0	2	0	2	0	1	1	1	0	2	1	0	40	1	1	1	0	0
902	1	1	1	0	2	0	3	0	0	1	1	0	1	0	0	59	1	1	1	0	0
903	1	1	1	0	2	0	3	0	0	1	1	0	2	1	0	59	1	1	1	0	0
904	1	3	0	0	2	0	3	0	0	1	1	0	2	1	0	42	1	1	1	0	0
905	1	3	0	0	2	0	3	0	0	1	1	0	2	1	0	66	1	1	1	0	0
906	1	1	1	0	2	0	3	0	0	1	1	0	1	0	0	43	1	1	1	0	0
907	1	3	0	0	2	0	3	0	0	1	1	0	2	1	0	27	1	1	1	0	0
908	1	1	1	0	2	0	3	0	0	1	1	0	1	0	0	48	1	1	1	0	0
909	1	3	0	0	2	0	3	0	0	1	1	0	2	1	0	37	1	1	1	0	0
910	1	3	0	0	2	0	3	0	0	1	1	0	1	0	0	52	1	1	1	0	0
911	1	1	1	0	2	0	3	0	0	1	1	0	1	0	0	46	1	1	1	0	0
912	1	3	0	0	2	0	3	0	0	1	1	0	1	0	0	37	1	1	1	0	0
913	1	3	0	0	2	0	3	0	0	1	1	0	2	1	0	29	1	1	1	0	0
914	1	3	0	0	2	0	3	0	0	1	1	0	2	1	0	17	1	1	1	0	0
915	1	1	1	0	2	0	3	0	0	1	1	0	2	1	0	61	1	1	1	0	0
916	1	1	1	0	2	0	3	0	0	1	1	0	2	1	0	51	1	1	1	0	0
917	1	1	1	0	2	0	3	0	0	1	1	0	2	1	0	42	1	1	1	0	0
918	1	1	1	0	2	0	3	0	0	1	1	0	1	0	0	61	1	1	1	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
919	1	3	0	0	2	0	3	0	0	1	1	0	1	0	0	26	1	1	1	0	0
920	1	3	0	0	2	0	3	0	0	1	1	0	1	0	0	48	1	1	1	0	0
921	1	1	1	0	2	0	3	0	0	1	1	0	2	1	0	61	1	1	1	0	0
922	1	3	0	0	2	0	3	0	0	1	1	0	1	0	0	47	1	1	1	0	0
923	1	3	0	0	2	0	3	0	0	1	1	0	2	1	0	49	1	1	1	0	0
924	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	56	1	1	1	0	0
925	0	1	1	0	2	0	3	0	0	1	1	0	1	0	0	25	1	1	1	0	0
926	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	54	1	1	1	0	0
927	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	21	1	1	1	0	0
928	0	3	0	0	2	0	3	0	0	1	1	0	1	0	0	41	1	1	1	0	0
929	0	1	1	0	2	0	3	0	0	1	1	0	1	0	0	35	1	1	1	0	0
930	0	1	1	0	1	1	3	0	0	1	1	0	3	0	1	36	1	1	1	0	0
931	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	32	1	1	1	0	0
932	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	37	1	1	1	0	0
933	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	29	1	1	1	0	0
934	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	37	1	1	1	0	0
935	0	1	1	0	2	0	3	0	0	1	1	0	1	0	0	37	1	1	1	0	0
936	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	53	1	1	1	0	0
937	0	3	0	0	2	0	1	1	0	1	1	0	2	1	0	29	1	1	1	0	0
938	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	36	1	1	1	0	0
939	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	33	1	1	1	0	0
940	0	3	0	0	2	0	3	0	0	1	1	0	2	1	0	46	1	1	1	0	0
941	0	3	0	0	2	0	3	0	0	1	1	0	1	0	0	29	1	1	1	0	0
942	0	3	0	0	2	0	3	0	0	1	1	0	2	1	0	61	1	1	1	0	0
943	0	3	0	0	2	0	3	0	0	1	1	0	1	0	0	37	1	1	1	0	0
944	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	30	1	1	1	0	0
945	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	61	1	1	1	0	0
946	0	1	1	0	2	0	3	0	0	1	1	0	3	0	1	31	1	1	1	0	0
947	0	1	1	0	2	0	3	0	0	1	1	0	3	0	1	25	1	1	1	0	0
948	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	59	1	1	1	0	0
949	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	56	0	1	1	0	0
950	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	34	0	1	1	0	0
951	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	31	1	1	1	0	0
952	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	26	1	1	1	0	0
953	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	48	1	1	1	0	0
954	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	63	1	1	1	0	0
955	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	53	1	1	1	0	0
956	0	3	0	0	2	0	3	0	0	1	1	0	1	0	0	42	1	1	1	0	0
957	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	35	0	1	1	0	0
958	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	33	1	1	1	0	0
959	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	42	1	1	1	0	0
960	0	3	0	0	2	0	2	0	1	1	1	0	1	0	0	45	1	1	1	0	0
961	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	46	1	1	1	0	0
962	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	50	1	1	1	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
963	0	3	0	0	2	0	1	1	0	1	1	0	1	0	0	44	1	1	1	0	0
964	0	3	0	0	2	0	2	0	1	1	1	0	3	0	1	41	1	1	1	0	0
965	0	3	0	0	2	0	3	0	0	1	1	0	3	0	1	25	1	1	1	0	0
966	0	3	0	0	2	0	3	0	0	1	1	0	2	1	0	51	1	1	1	0	0
967	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	45	0	1	1	0	0
968	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	55	1	1	1	0	0
969	0	1	1	0	1	1	3	0	0	1	1	0	1	0	0	24	1	1	1	0	0
970	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	27	1	1	1	0	0
971	0	2	0	1	2	0	2	0	1	1	1	0	3	0	1	58	0	1	1	0	0
972	0	3	0	0	2	0	1	1	0	1	1	0	2	1	0	55	1	1	1	0	0
973	0	3	0	0	2	0	3	0	0	1	1	0	2	1	0	41	1	1	1	0	0
974	0	3	0	0	2	0	3	0	0	1	1	0	1	0	0	54	1	1	1	0	0
975	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	36	0	1	1	0	0
976	0	3	0	0	2	0	1	1	0	1	1	0	2	1	0	54	1	1	1	0	0
977	0	1	1	0	2	0	3	0	0	1	1	0	1	0	0	26	1	1	1	0	0
978	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	55	1	1	1	0	0
979	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	55	1	1	1	0	0
980	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	55	1	1	1	0	0
981	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	43	1	1	1	0	0
982	0	3	0	0	2	0	3	0	0	1	1	0	2	1	0	52	1	1	1	0	0
983	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	31	1	1	1	0	0
984	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	35	1	1	1	0	0
985	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	44	1	1	1	0	0
986	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	54	1	1	1	0	0
987	0	3	0	0	2	0	1	1	0	1	1	0	2	1	0	60	1	1	1	0	0
988	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	40	0	1	1	0	0
989	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	43	0	1	1	0	0
990	0	1	1	0	2	0	1	1	0	1	1	0	3	0	1	41	1	1	1	0	0
991	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	29	1	1	1	0	0
992	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	27	1	1	1	0	0
993	0	3	0	0	2	0	1	1	0	1	1	0	1	0	0	44	1	1	1	0	0
994	0	1	1	0	2	0	3	0	0	1	1	0	1	0	0	36	1	1	1	0	0
995	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	38	1	1	1	0	0
996	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	38	1	1	1	0	0
997	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	35	1	1	1	0	0
998	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	23	1	1	1	0	0
999	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	48	1	1	1	0	0
1,000	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	52	1	1	1	0	0
1,001	0	3	0	0	1	1	3	0	0	1	1	0	1	0	0	62	1	1	1	0	0
1,002	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	36	0	1	1	0	0
1,003	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	52	1	1	1	0	0
1,004	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	53	1	1	1	0	0
1,005	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	38	1	1	1	0	0
1,006	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	54	1	1	1	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
1,007	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	54	1	1	1	0	0
1,008	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	54	1	1	1	0	0
1,009	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	54	1	1	1	0	0
1,010	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	55	1	1	1	0	0
1,011	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	47	1	1	1	0	0
1,012	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	26	1	1	1	0	0
1,013	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	21	1	1	1	0	0
1,014	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	28	1	1	1	0	0
1,015	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	63	0	1	1	0	0
1,016	0	3	0	0	2	0	2	0	1	1	1	0	1	0	0	49	1	1	1	0	0
1,017	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	53	1	1	1	0	0
1,018	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	47	1	1	1	0	0
1,019	0	3	0	0	2	0	3	0	0	1	1	0	2	1	0	58	1	1	1	0	0
1,020	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	51	1	1	1	0	0
1,021	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	37	1	1	1	0	0
1,022	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	42	1	1	1	0	0
1,023	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	29	1	1	1	0	0
1,024	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	54	1	1	1	0	0
1,025	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	43	1	1	1	0	0
1,026	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	34	1	1	1	0	0
1,027	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	56	1	1	1	0	0
1,028	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	47	1	1	1	0	0
1,029	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	47	1	1	1	0	0
1,030	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	29	1	1	1	0	0
1,031	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	61	1	1	1	0	0
1,032	0	3	0	0	2	0	2	0	1	1	1	0	1	0	0	54	1	1	1	0	0
1,033	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	46	1	1	1	0	0
1,034	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	39	1	1	1	0	0
1,035	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	35	1	1	1	0	0
1,036	0	1	1	0	2	0	1	1	0	1	1	0	3	0	1	45	1	1	1	0	0
1,037	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	38	1	1	1	0	0
1,038	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	50	1	1	1	0	0
1,039	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	55	1	1	1	0	0
1,040	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	26	1	1	1	0	0
1,041	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	53	0	1	1	0	0
1,042	0	1	1	0	2	0	1	1	0	1	1	0	1	0	0	47	1	1	1	0	0
1,043	0	1	1	0	2	0	3	0	0	1	1	0	1	0	0	37	1	1	1	0	0
1,044	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	53	1	1	1	0	0
1,045	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	51	1	1	1	0	0
1,046	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	47	1	1	1	0	0
1,047	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	46	1	1	1	0	0
1,048	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	29	0	1	1	0	0
1,049	0	1	1	0	1	1	3	0	0	1	1	0	3	0	1	57	1	1	1	0	0
1,050	0	1	1	0	2	0	1	1	0	1	1	0	1	0	0	44	1	1	1	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
1,051	0	3	0	0	2	0	3	0	0	1	1	0	2	1	0	46	1	1	1	0	0
1,052	0	3	0	0	2	0	3	0	0	1	1	0	1	0	0	47	1	1	1	0	0
1,053	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	38	1	1	1	0	0
1,054	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	25	1	1	1	0	0
1,055	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	24	1	1	1	0	0
1,056	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	52	1	1	1	0	0
1,057	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	56	1	1	1	0	0
1,058	0	3	0	0	2	0	2	0	1	1	1	0	1	0	0	46	1	1	1	0	0
1,059	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	35	1	1	1	0	0
1,060	0	1	1	0	2	0	1	1	0	1	1	0	1	0	0	24	1	1	1	0	0
1,061	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	43	1	1	1	0	0
1,062	0	3	0	0	2	0	1	1	0	1	1	0	1	0	0	44	1	1	1	0	0
1,063	0	3	0	0	2	0	3	0	0	1	1	0	2	1	0	34	1	1	1	0	0
1,064	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	49	0	1	1	0	0
1,065	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	42	1	1	1	0	0
1,066	0	3	0	0	2	0	2	0	1	1	1	0	1	0	0	48	1	1	1	0	0
1,067	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	52	1	1	1	0	0
1,068	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	39	1	1	1	0	0
1,069	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	56	1	1	1	0	0
1,070	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	51	1	1	1	0	0
1,071	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	54	1	1	1	0	0
1,072	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	47	1	1	1	0	0
1,073	0	3	0	0	2	0	3	0	0	1	1	0	2	1	0	43	1	1	1	0	0
1,074	0	1	1	0	1	1	3	0	0	1	1	0	3	0	1	39	0	1	1	0	0
1,075	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	60	1	1	1	0	0
1,076	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	48	1	1	1	0	0
1,077	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	36	1	1	1	0	0
1,078	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	42	1	1	1	0	0
1,079	0	3	0	0	2	0	1	1	0	1	1	0	2	1	0	57	1	1	1	0	0
1,080	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	38	1	1	1	0	0
1,081	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	48	1	1	1	0	0
1,082	0	2	0	1	2	0	1	1	0	1	1	0	3	0	1	34	1	1	1	0	0
1,083	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	56	1	1	1	0	0
1,084	0	1	1	0	2	0	1	1	0	1	1	0	3	0	1	46	1	1	1	0	0
1,085	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	21	1	1	1	0	0
1,086	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	32	1	1	1	0	0
1,087	0	1	1	0	1	1	2	0	1	1	1	0	2	1	0	57	1	1	1	0	0
1,088	0	3	0	0	2	0	2	0	1	1	1	0	1	0	0	39	1	1	1	0	0
1,089	0	3	0	0	2	0	3	0	0	1	1	0	1	0	0	58	1	1	1	0	0
1,090	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	36	1	1	1	0	0
1,091	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	26	1	1	1	0	0
1,092	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	26	1	1	1	0	0
1,093	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	53	1	1	1	0	0
1,094	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	30	1	1	1	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
1,095	0	1	1	0	1	1	3	0	0	1	1	0	2	1	0	54	1	1	1	0	0
1,096	0	3	0	0	2	0	3	0	0	1	1	0	1	0	0	49	1	1	1	0	0
1,097	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	33	1	1	1	0	0
1,098	0	3	0	0	2	0	3	0	0	1	1	0	1	0	0	41	1	1	1	0	0
1,099	0	1	1	0	2	0	3	0	0	1	1	0	3	0	1	31	1	1	1	0	0
1,100	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	42	1	1	1	0	0
1,101	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	62	0	1	1	0	0
1,102	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	59	1	1	1	0	0
1,103	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	36	1	1	1	0	0
1,104	0	3	0	0	1	1	3	0	0	1	1	0	3	0	1	38	1	1	1	0	0
1,105	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	57	1	1	1	0	0
1,106	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	22	1	1	1	0	0
1,107	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	62	1	1	1	0	0
1,108	0	1	1	0	2	0	3	0	0	1	1	0	3	0	1	27	1	1	1	0	0
1,109	0	1	1	0	2	0	3	0	0	1	1	0	3	0	1	35	1	1	1	0	0
1,110	0	3	0	0	2	0	1	1	0	1	1	0	2	1	0	55	1	1	1	0	0
1,111	0	2	0	1	2	0	3	0	0	1	1	0	1	0	0	61	1	1	1	0	0
1,112	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	39	1	1	1	0	0
1,113	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	48	0	1	1	0	0
1,114	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	36	1	1	1	0	0
1,115	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	41	1	1	1	0	0
1,116	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	36	1	1	1	0	0
1,117	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	49	1	1	1	0	0
1,118	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	41	1	1	1	0	0
1,119	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	48	1	1	1	0	0
1,120	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	53	1	1	1	0	0
1,121	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	30	1	1	1	0	0
1,122	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	58	1	1	1	0	0
1,123	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	48	1	1	1	0	0
1,124	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	42	0	1	1	0	0
1,125	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	38	1	1	1	0	0
1,126	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	44	0	1	1	0	0
1,127	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	42	0	1	1	0	0
1,128	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	33	1	1	1	0	0
1,129	0	3	0	0	2	0	2	0	1	1	1	0	1	0	0	47	0	1	1	0	0
1,130	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	47	1	1	1	0	0
1,131	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	33	1	1	1	0	0
1,132	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	39	1	1	1	0	0
1,133	0	1	1	0	2	0	3	0	0	1	1	0	1	0	0	57	1	1	1	0	0
1,134	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	59	1	1	1	0	0
1,135	0	3	0	0	2	0	2	0	1	1	1	0	2	1	0	39	0	1	1	0	0
1,136	0	1	1	0	2	0	3	0	0	1	1	0	1	0	0	59	1	1	1	0	0
1,137	0	3	0	0	2	0	3	0	0	1	1	0	1	0	0	40	1	1	1	0	0
1,138	0	1	1	0	2	0	1	1	0	1	1	0	1	0	0	46	1	1	1	0	0

OBS	ACCID	WRKPLC	INDAR	TRDSRVAR	DEVIAT	OVEDEV	INJURY	MSDWO	FRACAMP	PEACSC	MANUF	TRADE	SIZE	SME	LARGE	AGE	SEX	EMPSTAT	PERM	FIXTERM	TEMP
1,139	0	3	0	0	2	0	2	0	1	1	1	0	3	0	1	44	0	1	1	0	0
1,140	0	3	0	0	2	0	2	0	1	1	1	0	1	0	0	65	1	1	1	0	0
1,141	0	1	1	0	2	0	1	1	0	1	1	0	1	0	0	41	1	1	1	0	0
1,142	0	3	0	0	2	0	3	0	0	1	1	0	1	0	0	49	1	1	1	0	0
1,143	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	25	1	1	1	0	0
1,144	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	49	1	1	1	0	0
1,145	0	1	1	0	2	0	3	0	0	1	1	0	2	1	0	52	0	1	1	0	0
1,146	0	3	0	0	2	0	3	0	0	1	1	0	1	0	0	35	1	1	1	0	0
1,147	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	33	1	1	1	0	0
1,148	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	53	0	1	1	0	0
1,149	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	48	1	1	1	0	0
1,150	0	1	1	0	2	0	2	0	1	1	1	0	3	0	1	50	1	1	1	0	0
1,151	0	3	0	0	2	0	3	0	0	1	1	0	1	0	0	43	1	1	1	0	0
1,152	0	3	0	0	2	0	3	0	0	1	1	0	1	0	0	40	1	1	1	0	0
1,153	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	45	0	1	1	0	0
1,154	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	45	1	1	1	0	0
1,155	0	3	0	0	2	0	3	0	0	1	1	0	1	0	0	45	1	1	1	0	0
1,156	0	1	1	0	2	0	1	1	0	1	1	0	2	1	0	32	1	1	1	0	0
1,157	0	1	1	0	2	0	1	1	0	1	1	0	1	0	0	30	1	1	1	0	0
1,158	0	1	1	0	2	0	3	0	0	1	1	0	3	0	1	45	1	1	1	0	0
1,159	0	1	1	0	2	0	2	0	1	1	1	0	2	1	0	30	0	1	1	0	0
1,160	0	1	1	0	2	0	2	0	1	1	1	0	1	0	0	73	1	1	1	0	0

Source: ACT data

Note: OBS - Observations

Appendix 2 - SPSS outputs of the logistic regression models

Appendix 2.1 - Unrestricted logistic regression model

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	348.195	15	0.000
	Block	348.195	15	0.000
	Model	348.195	15	0.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	739.960 ^a	0.259	0.426

a. Estimation terminated at iteration number 7 because parameter estimates changed by less than 0.001.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	4.268	8	0.832

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	INDAR	0.511	0.256	3.986	1	0.046	1.667
	TRDSRVAR	2.326	1.055	4.858	1	0.028	10.233
	OVEDEV	1.535	0.636	5.817	1	0.016	4.642
	MSDWO	3.427	0.595	33.173	1	0.000	30.771
	FRACAMP	3.332	0.313	113.163	1	0.000	27.987
	MANUF	0.319	0.251	1.620	1	0.203	1.376
	TRADE	0.185	0.367	0.254	1	0.614	1.203
	SME	0.025	0.203	0.015	1	0.903	1.025
	LARGE	0.550	0.327	2.826	1	0.093	1.734
	AGE	0.026	0.009	8.928	1	0.003	1.026
	SEX	-0.146	1.607	0.008	1	0.928	0.864
	PERM	0.977	0.373	6.862	1	0.009	2.655
	FIXTERM	0.557	0.404	1.906	1	0.167	1.746
	TEMP	1.026	0.726	1.998	1	0.158	2.790
	AGE by SEX	-0.012	0.034	0.133	1	0.715	0.988
	Constant	-15.090	1.772	72.492	1	0.000	0.000

a. Variable(s) entered on step 1: INDAR, TRDSRVAR, OVEDEV, MSDWO, FRACAMP, MANUF, TRADE, SME, LARGE, AGE, SEX, PERM, FIXTERM, TEMP, AGE * SEX.

Appendix 2.2 - Sequential process of independent variables exclusion from the logistic regression model

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	INDAR	0.514	0.255	4.059	1	0.044	1.671
	TRDSRVAR	2.328	1.055	4.874	1	0.027	10.260
	OVEDEV	1.538	0.636	5.851	1	0.016	4.654
	MSDWO	3.427	0.595	33.179	1	0.000	30.779
	FRACAMP	3.332	0.313	113.188	1	0.000	27.995
	MANUF	0.319	0.251	1.614	1	0.204	1.375
	TRADE	0.185	0.367	0.255	1	0.613	1.203
	SME	0.025	0.203	0.015	1	0.903	1.025
	LARGE	0.552	0.327	2.842	1	0.092	1.736
	AGE	0.026	0.008	9.439	1	0.002	1.026
	PERM	0.976	0.373	6.852	1	0.009	2.653
	FIXTERM	0.557	0.404	1.905	1	0.167	1.746
	TEMP	1.024	0.726	1.991	1	0.158	2.784
	AGE by SEX	-0.015	0.010	2.544	1	0.111	0.985
	Constant	-15.104	1.766	73.118	1	0.000	0.000

a. Variable(s) entered on step 1: INDAR, TRDSRVAR, OVEDEV, MSDWO, FRACAMP, MANUF, TRADE, SME, LARGE, AGE, PERM, FIXTERM, TEMP, AGE * SEX.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	INDAR	0.517	0.253	4.161	1	0.041	1.677
	TRDSRVAR	2.328	1.055	4.871	1	0.027	10.259
	OVEDEV	1.535	0.635	5.839	1	0.016	4.642
	MSDWO	3.427	0.595	33.191	1	0.000	30.795
	FRACAMP	3.332	0.313	113.188	1	0.000	27.983
	MANUF	0.319	0.251	1.613	1	0.204	1.375
	TRADE	0.183	0.366	0.249	1	0.618	1.201
	LARGE	0.537	0.304	3.117	1	0.077	1.711
	AGE	0.026	0.008	9.479	1	0.002	1.026
	PERM	0.985	0.365	7.305	1	0.007	2.679
	FIXTERM	0.568	0.395	2.065	1	0.151	1.764
	TEMP	1.031	0.723	2.035	1	0.154	2.804
	AGE by SEX	-0.016	0.010	2.571	1	0.109	0.985
	Constant	-15.096	1.765	73.147	1	0.000	0.000

a. Variable(s) entered on step 1: INDAR, TRDSRVAR, OVEDEV, MSDWO, FRACAMP, MANUF, TRADE, LARGE, AGE, PERM, FIXTERM, TEMP, AGE * SEX.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	INDAR	0.550	0.252	4.746	1	0.029	1.733
	TRDSRVAR	2.463	1.047	5.533	1	0.019	11.741
	OVEDEV	1.543	0.634	5.922	1	0.015	4.681
	MSDWO	3.428	0.595	33.215	1	0.000	30.808
	FRACAMP	3.335	0.313	113.591	1	0.000	28.079
	MANUF	0.331	0.251	1.748	1	0.186	1.393
	TRADE	0.334	0.354	0.891	1	0.345	1.397
	LARGE	0.576	0.302	3.644	1	0.056	1.779
	AGE	0.024	0.008	8.352	1	0.004	1.024
	PERM	1.016	0.364	7.798	1	0.005	2.763

FIXTERM	0.601	0.394	2.322	1	0.128	1.824
TEMP	1.100	0.719	2.343	1	0.126	3.004
Constant	-15.507	1.744	79.050	1	0.000	0.000

a. Variable(s) entered on step 1: INDAR, TRDSRVAR, OVEDEV, MSDWO, FRACAMP, MANUF, TRADE, LARGE, AGE, PERM, FIXTERM, TEMP.

Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a INDAR	0.588	0.248	5.611	1	0.018	1.801
TRDSRVAR	2.480	1.046	5.628	1	0.018	11.945
OVEDEV	1.537	0.634	5.875	1	0.015	4.652
MSDWO	3.417	0.594	33.029	1	0.000	30.466
FRACAMP	3.331	0.313	113.413	1	0.000	27.952
MANUF	0.273	0.243	1.268	1	0.260	1.315
LARGE	0.563	0.301	3.497	1	0.061	1.756
AGE	0.025	0.008	8.915	1	0.003	1.025
PERM	1.032	0.363	8.075	1	0.004	2.808
FIXTERM	0.610	0.394	2.399	1	0.121	1.840
TEMP	1.059	0.718	2.177	1	0.140	2.884
Constant	-15.174	1.703	79.363	1	0.000	0.000

a. Variable(s) entered on step 1: INDAR, TRDSRVAR, OVEDEV, MSDWO, FRACAMP, MANUF, LARGE, AGE, PERM, FIXTERM, TEMP.

Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a INDAR	0.726	0.217	11.189	1	0.001	2.067
TRDSRVAR	2.478	1.046	5.613	1	0.018	11.912
OVEDEV	1.617	0.632	6.544	1	0.011	5.040
MSDWO	3.414	0.594	33.002	1	0.000	30.398
FRACAMP	3.327	0.313	113.294	1	0.000	27.851
LARGE	0.522	0.299	3.054	1	0.081	1.685
AGE	0.025	0.008	9.210	1	0.002	1.025
PERM	1.043	0.363	8.269	1	0.004	2.838
FIXTERM	0.598	0.393	2.318	1	0.128	1.819
TEMP	0.963	0.715	1.815	1	0.178	2.619
Constant	-15.029	1.700	78.196	1	0.000	0.000

a. Variable(s) entered on step 1: INDAR, TRDSRVAR, OVEDEV, MSDWO, FRACAMP, LARGE, AGE, PERM, FIXTERM, TEMP.

Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a INDAR	0.749	0.216	11.990	1	0.001	2.115
TRDSRVAR	2.545	1.048	5.900	1	0.015	12.745
OVEDEV	1.643	0.634	6.722	1	0.010	5.168
MSDWO	3.423	0.594	33.165	1	0.000	30.665
FRACAMP	3.339	0.312	114.372	1	0.000	28.177
LARGE	0.566	0.298	3.616	1	0.057	1.762
AGE	0.027	0.008	11.366	1	0.001	1.028
PERM	0.584	0.197	8.776	1	0.003	1.792
TEMP	0.471	0.640	0.542	1	0.462	1.602
Constant	-14.213	1.608	78.122	1	0.000	0.000

a. Variable(s) entered on step 1: INDAR, TRDSRVAR, OVEDEV, MSDWO, FRACAMP, LARGE, AGE, PERM, TEMP.

Appendix 2.3 - Restricted logistic regression model

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	340.219	8	0.000
	Block	340.219	8	0.000
	Model	340.219	8	0.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	747.936 ^a	0.254	0.418

a. Estimation terminated at iteration number 7 because parameter estimates changed by less than 0.001.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	4.255	8	0.833

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	INDAR	0.764	0.215	12.584	1	0.000	2.148
	TRDSRVAR	2.557	1.047	5.961	1	0.015	12.902
	OVEDEV	1.641	0.633	6.726	1	0.010	5.160
	MSDWO	3.416	0.594	33.042	1	0.000	30.456
	FRACAMP	3.331	0.312	114.022	1	0.000	27.962
	LARGE	0.590	0.296	3.977	1	0.046	1.805
	AGE	0.027	0.008	11.565	1	0.001	1.028
	PERM	0.554	0.193	8.222	1	0.004	1.740
	Constant	-13.782	1.490	85.574	1	0.000	0.000

a. Variable(s) entered on step 1: INDAR, TRDSRVAR, OVEDEV, MSDWO, FRACAMP, LARGE, AGE, PERM.

Appendix 3 - Sample data from the Annual Single Report on OSH Service Activities of 2014

OBS	EMCPER	EMSC	EMFSC	EMNSC	EMCVT	EMCOSH	EMPERSER	EMHRNPABS	EMHRPABS	EMMAXWKHR	EMNP	EMTEMP	EMUNIWRK	EMGVA	EMBV	ESEMCYWRK	ESHRWRK
1	27,972	60,000	0	100	0	2,534	1	0	0	2,935	651	0	0	65,223	189,138	1	2,984
2	0	10,370	0	100	200	503	7	0	0	0	0	0	0	0	139,813	1	13,096
3	0	5,000	0	100	0	0	13	1,456	0	16,109	0	0	0	0	161,455	0	14,605
4	0	5,000	0	100	0	0	5	0	0	0	0	0	0	0	107,340	1	8,988
5	0	50,000	0	100	0	0	0	0	0	0	0	0	0	0	399,698	0	3,615
6	0	1	0	100	253	3,931	2	0	0	0	0	0	0	0	0	3	5,359
7	0	10,000	0	100	34	2,677	6	242	0	12,479	0	0	0	0	134,517	1	11,616
8	104,032	5,000	0	100	153,345	384,479	9	159	0	16,047	15,778	0	0	151,239	290,001	0	16,047
9	113,809	0	0	0	5,136	0	20	2,760	835	31,692	-38,721	0	0	34,199	126,906	0	13,554
10	0	5,000	0	100	0	54,404	4	0	0	0	0	0	0	0	132,855	1	7,096
11	629,452	210,000	0	100	0	310	28	3,207	0	55,355	-112,758	0	0	553,613	1,777,167	5	53,955
12	0	2,500	0	100	0	0	32	4,168	0	90,200	0	0	7	0	645,330	0	77,624
13	0	5,986	0	100	545,345	545,875	3	432	0	7,107	0	0	0	0	38,582	1	6,442
14	1,892,283	0	0	0	0	12,581	171	20,741	69	332,364	163,668	0	20	0	517,880	6	141,869
15	0	5,000	0	100	7,500	315,363	10	2,003	0	26,280	0	0	0	0	247,985	2	16,160
16	0	50,000	0	100	0	25,342	9	2,280	0	14,664	0	0	0	0	521,610	1	16,047
17	2,048,740	150,000	0	100	0	0	132	128,623	0	524,626	34,866	0	0	2,272,272	2,647,718	1	203,408
18	600,147	150,000	0	100	0	0	44	4,773	59	78,540	33,105	0	0	1,832,065	2,535,531	4	64,469
19	897,473	250,000	0	100	80,900	50,701	36	2,626	360	68,400	158,742	0	0	1,293,047	2,684,644	6	18,283
20	3,000,399	2,820,000	0	100	127	1,075	132	0	0	253,895	505,262	0	0	4,118,735	18,086,017	2	266,556
21	283,892	49,880	0	100	0	0	20	84	262	37,482	2,351	0	0	1,086,537	3,434,467	0	37,482
22	329,527	125,000	0	100	1,448	1,101	18	0	0	35,584	-65,502	0	0	289,248	671,969	1	41,028
23	0	125,000	0	100	0	0	7	0	0	0	0	0	0	0	411,920	1	11,792
24	800,620	250,000	0	100	1,682	2,270	64	6,664	136	109,696	71,907	0	0	1,152,473	2,906,934	0	38,728
25	617,417	74,819	0	100	4,190	33,966	37	2,588	158	64,624	11,693	0	2	1,386,112	6,081,266	4	29,971
26	782,323	5,000	0	100	0	0	51	12,668	0	95,170	12,902	0	0	2,382	1,443,649	1	82,502
27	0	5,000	0	100	0	2,835	7	0	0	0	0	0	0	0	114,576	3	10,065
28	0	5,000	0	100	0	270	2	0	0	0	0	0	0	0	39,016	2	4,176
29	513,898	15,000	0	100	243,523	65,637	273	0	0	379,040	3,081	0	0	641,747	4,484,771	1	87,546
30	519,471	100,000	0	100	8,850	2,055	40	4,356	136	69,668	214,875	0	0	951,857	7,801,603	6	70,828
31	43,082,486	58,450,000	0	100	756,342	337,698	801	50,767	209,113	1,617,505	2,473,259	0	60	56,924,708	129,000,000	1	17,984
32	2,463,419	0	0	0	24	86	107	0	0	228,360	593,668	4	18	3,942,204	33,231,910	18	281,682
33	719,848	174,579	0	100	0	768	23	4,424	0	69,152	0	0	7	1	3,722,460	0	41,397
34	385,376	150,000	0	100	3,915	3,828	18	552	248	39,360	544,796	1	0	1,109,860	5,496,586	9	39,604
35	0	5,000	0	100	3,253	598,330	3	0	0	0	0	0	0	0	200,451	3	4,432
36	13,530,404	23,126,795	100	0	331	6,806	424	31,974	26,565	749,977	-677,430	43	279	17,681,171	109,000,000	5	724,631
37	365,917	123,339	0	100	551	0	29	242	0	58,256	13,448	0	0	454,152	9,178,190	3	49,750
38	0	5,000	0	100	0	3,990	3	0	0	0	0	0	0	0	263,331	0	6,487
39	442,527	250,000	0	100	0	2,048	21	6,629	120	41,244	71,881	0	0	948,478	2,141,881	4	33,847
40	0	50,000	0	100	1,253	5,000	5	0	0	0	0	0	0	0	139,616	1	520
41	0	50,000	0	100	0	0	5	0	0	0	0	0	0	0	139,616	1	7,251
42	1,255,790	498,797	0	100	3,556	34,490	63	10,926	0	109,777	-1,322,142	0	0	1,796,909	3,587,130	0	9,426
43	766,406	100,000	0	100	1,365	1,040	30	5,648	0	53,360	230,935	0	0	1,870,973	2,158,785	3	32,681
44	2,898,381	1,085,000	0	100	0	56	194	7,694	0	369,182	407,580	0	0	5,505,494	14,438,946	4	361,488
45	0	125,000	0	100	0	615	21	0	0	58,238	0	0	0	0	1,961,362	5	46,779
46	15,321,393	6,035,460	100	0	31	322	486	52,566	5,512	935,514	-2,214,074	119	287	24,866,774	93,339,012	15	861,691
47	2,288,162	0	0	0	0	3,324	241	19,659	698	354,824	1,220,000	0	1	4,313,349	3,320,493	4	257,872
48	466,705	200,000	0	100	45	1,470	33	3,918	0	53,824	1,204	0	0	695,426	5,377,349	1	48,236

OBS	EMCPER	EMSC	EMFSC	EMNSC	EMCVT	EMCOSH	EMPER	EMHRNPABS	EMHRPABS	EMMAXWKHR	EMNP	EMTEMP	EMUNIWRK	EMGVA	EMBV	ESEMCYWRK	ESHRWRK
49	0	5,000	0	100	0	253,421	6	220	0	10,555	0	0	0	0	18,589,400	0	10,555
50	1,030,410	872,455	0	100	522,461	266,999	86	0	0	120,864	19,088	0	0	2,415,538	7,440,223	1	96,296
51	2,692,592	1,200,000	0	100	235,232	600,173	98	1,742	18,850	127,924	344,106	1	6	1,339,548	60,973,952	8	77,500
52	766,272	150,000	0	100	0	0	37	0	0	105,600	1,574,867	0	0	672,913	1,205,277	2	88,934
53	0	125,000	0	100	0	30	8	0	0	0	0	0	0	0	1,799,937	1	11,616
54	138,418	5,000	0	100	5,253	4,826	16	3,868	0	33,262	4,903	0	0	22,610	480,097	1	29,394
55	0	17,500	0	100	0	52,421	33	1,664	4,744	59,256	0	1	0	0	1,200,000	12	50,067
56	5,023,000	1,500,000	0	100	477	346	146	0	0	303,360	0	98	0	6,281,321	17,923,428	2	286,080
57	5,214,594	3,541,465	100	0	621	2,703	183	107,013	7,606	432,201	1,875,650	1	99	8,380,523	47,623,029	5	148,180
58	5,555,894	19,710,500	0	100	282	1,370	159	13,047	7,970	309,128	-732,626	0	63	11,656,629	66,790,267	3	289,839
59	5,281,758	750,000	0	100	289	1,334	243	13,808	2,078	462,360	823,523	0	0	6,899,565	19,305,216	3	480,859
60	5,067,153	8,500,000	0	100	157	1,030	310	34,620	1,404	658,314	605,006	76	87	14,906	22,637,923	15	620,714
61	0	250	0	100	0	35,141	2	0	0	0	0	0	0	0	69,956	1	3,293
62	7,812,075	2,004,820	0	100	172	7,103	291	18,913	6,299	531,867	149,421	15	19	5,916,618	57,311,741	12	1,074,777
63	5,842,474	8,550,000	0	100	237,028	247,009	187	41,054	9,358	356,420	7,237,847	0	39	15,209,215	76,161,347	48	307,278
64	1,837,659	50,000	0	100	0	9,259	46	59,695	0	170,226	14,859	0	0	2,586,618	2,676,869	2	110,527
65	153,892	5,000	0	100	0	0	13	1,906	0	19,360	16,063	0	0	200,014	505,233	0	19,883
66	8,265,806	14,000,000	0	100	1,666,340	5,253,459	386	34,298	2,939	724,113	952,985	23	83	10,677,952	27,010,078	1	49,376
67	2,847,609	1,316,000	0	100	0	0	171	0	0	299,504	-2,013,286	0	35	2,444,081	8,172,373	7	28,528
68	9,236,262	19,204,000	100	0	572	4,661	358	14,952	2,433	662,791	1,284,729	0	1	17,108,329	142,000,000	13	309,021
69	29,765,852	20,000,000	0	100	0	1,469	546	61,715	1,842	1,002,404	9,105,790	0	5	61,484,301	217,000,000	12	995,661
70	28,403,930	2,000,000	0	100	146	39	1,770	142,671	137,064	618,850	142,599	0	121	1,314,229	30,930,094	6	4,858,756
71	0	5,000	0	100	252	235	3	0	0	0	0	0	0	0	65,319	2	5,344
72	14,969,694	50,000,000	0	100	60,115	74,606	369	19,843	23,047	756,360	-584,193	0	160	33,366,060	219,000,000	5	220,726
73	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	1	14,320
74	2,406,110	200,000	0	100	0	0	79	25,222	629	140,912	0	0	0	2,651,471	3,782,277	6	121,440
75	125,939	0	0	0	0	0	12	0	0	19,648	20,021	0	0	416,104	508,925	1	19,874
76	369,637	35,000	0	100	0	0	30	1,873	0	62,659	509	6	0	419,055	1,139,954	1	36,480
77	1,253,919	0	0	0	0	2,236	89	18,111	540	244,721	-70,409	0	0	81,268	922,160	7	91,450
78	163,727	6,000	0	100	254,346	5,338	18	4,616	0	27,435	25,114	0	0	216,814	301,644	1	1,740
79	0	5,000	0	100	0	0	4	0	0	0	0	0	0	0	536,219	3	7,296
80	40,923,918	62,500,000	0	100	1,086,221	693,675	2,770	297,718	141,337	4,793,839	45,558,137	0	0	0	501,000,000	24	180,680
81	214,077	50,000	0	100	0	3,237	18	2,574	2,409	35,844	3,795	0	0	223,359	531,041	4	3,082
82	6,624,563	60,000	0	100	353	74	216	248,271	0	681,360	58,191	0	69	57,989	6,961,161	1	433,088
83	25,870,309	450,000	0	100	17	35	1,616	160,786	4,090	2,847,496	1,103,052	0	7	26,865,684	29,576,514	22	2,846,552
84	4,227,180	25,000	0	100	0	0	173	189,770	33,218	531,260	0	148	0	5,256,879	7,126,903	1	32,130
85	676,241	400,000	0	100	25,310	296,812	37	40	0	68,308	0	0	3	2,727,997	2,230,726	11	53,270
86	3,590,696	500,000	0	100	6,774	699	44	4,704	9,471	88,598	82,470	0	13	3,975,344	13,173,796	5	27,138
87	0	40,000	0	100	0	0	0	72	0	1,152	0	0	0	0	0	1	3,126
88	10,386,181	250,000	0	100	3,296	2,599	1,929	221,956	185,965	2,464,352	-435,169	0	214	11,033,305	14,638,446	1	113,498
89	58,564,681	200,000,000	86	14	318	2,282	2,890	124,345	248,326	5,337,674	225,724,746	0	2,374	746,300,192	3,160,000,000	9	356,506
90	58,564,681	200,000,000	86	14	31,824,720	11,230,518	2,890	124,345	248,326	5,337,674	225,724,746	0	2,374	746,300,192	3,160,000,000	7	64,167
91	53,718,711	1,263,285,505	86	14	0	0	1,008	28,777	123,557	1,852,702	247,970,261	0	668	834,805,380	1,350,000,000	12	429,745
92	1,598,998	615,000	0	100	0	9,044	94	5,669	462	151,725	0	0	0	2,379,022	9,159,748	6	141,577
93	2,406,110	200,000	0	100	0	0	79	25,222	629	140,912	0	0	0	2,651,471	3,782,277	2	118,323
94	0	5,000	0	100	77,542	62,809	9	0	0	0	0	0	0	0	243,849	1	15,648
95	879,006	50,000	0	100	2,209	23,119	59	0	0	114,356	33,438	0	0	939,347	939,347	0	72,575
96	10,901,570	51,035,000	0	100	11,426	25,628	200	5,865	2,591	317,748	11,837,120	0	42	37,626,115	46,902,924	3	313,871
97	65,653,790	6,250,000	0	100	0	111	2,357	459,824	0	5,251,952	0	0	1	66,854,740	169,000,000	1	3,675,274
98	5,866,689	2,495,000	0	100	0	0	322	66,645	771	667,120	0	0	70	6,092,491	30,988,379	5	566,160

Source: Own elaboration, based on the data collected by GEP through the 'Annex Zero' and Annex D' of the Annual Single Report on OSH Service Activities (see Annexes 1 and 2).

Appendix 3 - Sample Data from the Annual Single Report on OSH Service Activities of 2014 (Cont)

OBS	ESAVEE	ESAVOTWRK	ESAVPERSER	ESBIORSKFAC	ESPHYRSKFAC	ESMSDRSKFAC	ESPSYRSKFAC	ESCHERSKFAC	ESCOVCONSAC	ESCOVTRAIAC	ESCOVINFOAC	ESCOVHEAPRAC	ESCOVHEAEXA	ESCOVRSKMEA	ESOTHRSKMEA	ESBIORSKMEA
1	2	0	2	0	1	3	0	0	1.0000	0.0000	1.0000	0.0000	0.0000	3.4440	18	0
2	7	0	7	0	3	3	0	3	1.0000	0.0000	1.0000	0.0000	0.0000	5.7690	23	0
3	9	0	9	0	0	0	0	0	0.0000	0.0000	0.0000	0.0000	0.7778	0.0000	0	0
4	6	0	6	0	2	1	0	1	0.0000	0.8333	0.0000	0.0000	1.6667	1.5000	0	0
5	4	0	4	0	4	3	1	0	0.0000	0.0000	0.0000	0.0000	1.7500	1.2310	8	0
6	2	0	2	0	0	0	0	0	1.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0	0
7	6	0	6	0	0	2	0	0	0.0000	0.0000	0.0000	0.0000	0.0000	3.0000	0	0
8	11	0	11	0	2	3	0	1	1.0000	0.1818	0.9091	0.0000	1.2727	1.3330	0	0
9	17	0	17	0	0	2	0	0	0.0000	0.0000	0.7059	0.0000	0.0000	2.2000	6	0
10	4	0	4	0	0	0	0	0	1.0000	0.0000	0.7500	0.0000	1.5000	0.0000	0	0
11	29	0	29	0	0	0	0	0	1.0000	0.2069	0.1724	0.0000	0.0000	1.1670	35	0
12	36	0	36	0	0	20	0	0	0.0000	0.0000	0.2778	0.0000	1.3056	1.5910	5	0
13	4	0	4	0	2	2	0	1	0.0000	0.0000	0.7500	0.0000	1.7500	4.3750	16	0
14	73	4	77	0	2	3	0	0	0.9481	0.8442	0.9091	1.3699	1.0000	3.8750	13	0
15	10	0	10	0	0	0	0	0	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0	0
16	8	0	8	1	3	3	0	1	1.0000	1.0000	0.8750	0.0000	2.0000	3.1110	2	5
17	135	0	135	0	0	9	0	0	0.0000	0.1630	0.1630	0.0000	0.7556	0.6670	0	0
18	137	0	137	0	0	0	0	0	0.2847	0.0803	0.2847	0.0000	0.6861	0.8330	10	0
19	9	0	9	0	2	3	0	4	1.0000	1.0000	1.0000	0.0000	0.0000	2.0000	9	0
20	140	0	140	0	20	3	0	0	0.3214	0.1071	0.4643	0.0000	0.8643	0.6070	11	0
21	20	0	20	0	0	0	0	0	0.8500	0.0000	0.4000	1.7500	1.7500	0.0000	0	0
22	20	0	20	0	0	0	0	0	0.7500	0.0000	0.8000	0.7500	0.6000	0.0000	0	0
23	9	0	9	0	0	0	0	0	0.0000	0.8889	1.0000	0.0000	1.1111	0.0000	0	0
24	22	0	22	0	0	4	3	0	1.0000	0.0000	0.6818	0.0000	0.0000	2.1670	14	0
25	18	0	18	0	1	1	0	0	1.0000	0.9444	1.0000	0.0000	0.0000	4.4290	23	0
26	51	0	51	0	0	0	0	0	0.0000	0.7843	0.0000	0.0000	0.9216	0.0000	0	0
27	7	0	7	0	2	1	2	1	1.0000	1.0000	1.0000	0.0000	0.0000	5.1250	11	0
28	2	0	2	0	0	1	0	0	1.0000	1.0000	1.0000	0.0000	2.0000	2.5000	3	0
29	46	0	46	0	0	0	0	0	1.0000	1.0000	0.9783	0.0000	1.0217	0.0000	0	0
30	40	0	40	0	2	1	3	0	1.0000	1.0000	1.0000	0.0000	1.0500	6.0000	12	0
31	16	39	55	0	0	3	0	5	1.0000	0.9091	0.9091	1.8750	1.0000	4.9170	13	0
32	350	2,000	2,350	0	200	150	1	100	0.0000	0.0340	0.3404	0.0000	0.0000	0.1890	45	0
33	20	0	20	0	10	5	5	0	0.0000	0.0000	0.0500	1.0000	0.8000	1.3330	12	0
34	19	0	19	1	1	1	2	40	0.0000	0.2105	0.3158	0.0000	0.8947	1.3620	2	3
35	3	0	3	0	1	2	0	0	1.0000	1.0000	1.0000	2.0000	1.3333	5.0000	0	0
36	417	62	479	1	100	50	0	20	0.0251	0.2067	0.0063	0.0000	0.0000	0.6160	12	1
37	29	0	29	0	3	4	0	0	0.0000	0.8621	1.0000	0.0000	0.0000	2.8330	16	0
38	4	0	4	0	0	0	0	0	0.0000	0.7500	1.0000	0.0000	0.0000	0.0000	0	0
39	21	0	21	0	0	2	0	7	0.9524	0.8571	0.9524	0.0000	0.6667	1.2730	5	0
40	1	0	1	0	1	0	0	0	1.0000	1.0000	1.0000	0.0000	0.0000	3.0000	0	0
41	4	0	4	0	0	0	0	0	1.0000	0.0000	1.0000	0.0000	1.2500	0.0000	0	0
42	6	0	6	0	3	4	1	1	1.0000	1.0000	1.0000	3.3333	2.3333	2.4290	13	0
43	17	0	17	0	15	5	1	0	0.5882	0.8824	0.8824	0.0000	0.0000	1.2690	8	0
44	190	0	190	0	0	5	5	0	0.2632	0.0000	0.0000	0.0000	0.0000	0.7880	12	0
45	26	0	26	0	0	0	0	0	0.0000	1.0000	0.2692	1.5385	0.6538	1.6000	8	0
46	760	224	984	2	150	2	0	1	0.0000	0.0224	0.0305	0.0000	0.0000	0.1540	6	0
47	141	0	141	1	50	2	0	1	0.0000	0.0000	0.0000	1.2411	0.5106	1.0730	2	3
48	32	0	32	0	0	0	0	0	1.0000	1.0000	0.3125	0.0000	1.6875	0.0000	0	0

OBS	ESAVEE	ESAVOTWRK	ESAVPERSER	ESBIORSKFAC	ESPHYRSKFAC	ESMSDRSKFAC	ESPSYRSKFAC	ESCHERSKFAC	ESCOVCONSAC	ESCOVTRAIAC	ESCOVINFOAC	ESCOVHEAPRAC	ESCOVHEAEXA	ESCOVRSKMEA	ESOTHRSKMEA	ESBIORSKMEA
49	7	0	7	0	0	0	0	0	0.0000	0.0000	0.5714	0.0000	0.0000	0.0000	0	0
50	37	0	37	0	5	3	1	0	1.0000	1.0000	0.9459	0.0000	1.0811	3.0000	15	0
51	42	0	42	0	1	3	0	1	0.5952	0.9286	1.0000	0.0000	0.0000	3.3750	13	0
52	55	1	56	0	0	24	0	0	0.0000	0.5357	0.5357	0.0000	0.7273	1.2190	71	0
53	8	0	8	0	0	0	0	0	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0	0
54	15	0	15	0	0	0	0	0	1.0000	1.0000	0.9333	0.0000	0.0000	0.0000	0	0
55	31	0	31	0	0	2	0	0	0.8387	0.9677	0.9677	0.0000	0.0000	3.4290	19	0
56	349	88	437	0	0	0	0	0	0.0618	0.0549	0.1876	0.0000	0.4269	0.0000	0	0
57	83	20	103	0	28	5	1	28	0.0777	0.0485	0.0097	0.3614	0.7831	0.8260	25	0
58	166	0	166	0	3	0	0	0	0.0120	0.1566	0.0000	0.0000	0.9036	0.6670	0	0
59	255	0	255	0	10	0	0	0	0.3922	0.0549	0.1059	0.2039	0.7843	0.6500	6	0
60	607	0	607	0	0	0	0	0	0.2471	0.0379	0.0000	0.0000	0.6442	0.0000	0	0
61	3	0	3	0	0	2	0	0	1.0000	1.0000	1.0000	3.3333	2.3333	3.5000	8	0
62	288	15	303	0	12	11	0	13	0.0528	0.2112	0.3300	0.1979	0.5833	0.3890	0	0
63	180	80	260	1	3	2	2	1	1.0000	0.8615	0.1077	0.0000	4.3556	3.3330	12	5
64	100	0	100	0	20	1	0	0	0.0000	0.0000	0.0000	0.0000	0.9300	1.1360	1	0
65	11	0	11	0	0	0	0	0	0.8182	0.9091	0.9091	0.0000	1.5455	0.0000	0	0
66	66	0	66	0	1	0	0	0	0.6818	0.8333	0.9091	0.0000	0.3030	0.0000	0	0
67	167	0	167	0	1	1	0	0	0.0000	0.0000	0.3593	0.0000	0.7186	0.5000	0	0
68	265	0	265	0	150	2	1	70	0.0868	0.1774	0.3396	0.0000	0.0000	0.3070	27	0
69	668	350	1,018	0	50	70	0	50	0.5727	0.0982	0.0049	0.0823	0.5958	0.2760	0	0
70	7,715	500	8,215	0	0	0	0	0	0.0000	0.0038	0.0035	0.0000	0.4603	0.0000	0	0
71	4	7	11	0	0	3	0	0	1.0000	1.0000	0.9091	2.5000	0.0000	3.8000	9	0
72	127	460	587	0	5	0	0	100	0.3629	0.1261	0.2129	0.2362	0.7717	1.1600	33	0
73	8	0	8	0	3	4	0	1	1.0000	0.0000	2.0000	0.0000	1.1250	3.0000	9	0
74	168	0	168	0	0	0	0	0	0.1429	0.1071	0.2976	0.0000	0.7143	0.0000	0	0
75	12	0	12	0	1	0	0	1	0.5833	0.8333	1.0000	0.0000	0.0000	1.5000	0	0
76	20	0	20	0	0	0	0	0	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0	0
77	46	0	46	0	0	2	0	0	0.0000	0.0000	0.1739	0.0000	1.3913	1.5000	0	0
78	18	0	18	0	0	0	0	0	1.0000	0.8889	1.0000	0.0000	0.0000	0.0000	0	0
79	4	0	4	0	0	0	0	0	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0	0
80	91	20	111	0	1	2	3	0	0.9009	0.8108	0.9009	1.6484	2.7473	3.8750	9	0
81	18	0	18	0	0	0	0	0	0.8889	0.8333	0.5556	0.0000	1.1111	4.5000	9	0
82	237	0	237	0	0	0	0	0	0.0000	0.0084	0.0000	0.0000	0.0506	0.0000	0	0
83	1,588	1,500	3,088	0	20	10	0	0	0.0000	0.1046	0.0486	0.1259	0.4326	0.2060	3	0
84	399	0	399	0	0	0	0	0	0.0000	0.0702	0.1504	0.0000	0.0000	0.0000	0	0
85	22	0	22	0	2	2	1	17	0.9091	0.9091	0.9091	3.1818	1.1364	6.1820	0	0
86	15	72	87	0	30	0	10	0	0.0460	0.0000	0.1724	0.0000	0.8667	1.0500	23	0
87	2	0	2	0	2	2	0	0	1.0000	1.0000	1.0000	5.5000	2.0000	3.1430	11	0
88	120	0	120	1	30	20	1	40	0.2083	0.0750	0.3333	0.0000	0.0000	0.7930	0	1
89	203	109	312	0	8	0	0	0	0.3205	0.1250	0.1923	0.0000	0.0000	0.7500	0	0
90	36	80	116	0	1	0	0	0	0.8621	1.0000	1.0000	0.0000	1.3333	5.0000	0	0
91	600	3,320	3,920	0	100	0	0	0	0.0638	0.0115	0.0638	0.0000	0.5017	0.2300	0	0
92	189	32	221	0	0	15	0	0	0.0000	0.0860	0.0679	0.3757	0.6402	0.6670	0	0
93	184	0	184	0	0	10	0	0	0.2609	0.1413	0.5054	0.0000	0.0000	0.8000	0	0
94	8	0	8	0	1	0	0	0	1.0000	0.8750	1.0000	3.1250	2.1250	4.0000	0	0
95	65	0	65	0	1	25	3	0	0.0000	0.9385	0.4615	0.0000	1.2308	1.3290	82	0
96	202	238	440	1	45	1	0	4	0.1477	0.0636	0.2727	0.3564	0.6733	1.2590	6	2
97	2,079	0	2,079	0	0	0	0	0	0.0000	0.0000	0.0000	0.0000	0.5969	0.0000	0	0
98	291	0	291	0	0	0	0	0	0.0000	0.0928	0.2749	0.0000	0.7560	0.0000	0	0

Source: Own elaboration, based on the data collected by GEP through the ‘Annex Zero’ and Annex D’ of the Annual Single Report on OSH Service Activities (see Annexes 1 and 2).

Appendix 3 - Sample Data from the Annual Single Report on OSH Service Activities of 2014 (Cont)

OBS	ESPHYRSKMEA	ESMSDRSKMEA	ESPSYRSKMEA	ESCHERSKMEA	ESOTHRSKFAC	ESTOTRSKMEA	ESRSKPREV	ESHEAPROM	ESHEASHA	ESHEAEXT	ESHEAINT	ESPRSE	ESSESE	ESTESE	ESSAFINT	ESSAFEXT	ESSAFSHA	TWRA
1	4	9	0	0	5	31	1	1	0	1	0	0	1	0	0	1	0	1
2	19	13	0	20	4	75	1	1	0	1	0	0	1	0	0	0	1	1
3	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	7
4	2	1	0	3	0	6	1	1	1	0	0	0	1	0	0	0	1	2
5	3	3	2	0	5	16	1	0	0	1	0	0	0	1	0	0	1	2
6	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	1
7	0	6	0	0	0	6	1	1	1	0	0	0	1	0	0	0	1	1
8	2	2	0	4	0	8	0	0	0	1	0	0	1	0	0	0	1	1
9	0	5	0	0	3	11	1	0	0	1	0	1	0	0	0	1	0	3
10	0	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	1	1
11	0	0	0	0	30	35	0	0	0	1	0	0	0	1	0	1	0	5
12	0	30	0	0	2	35	0	0	0	1	0	0	1	0	0	1	0	4
13	7	7	0	5	3	35	1	0	0	0	1	0	1	0	0	0	1	1
14	8	10	0	0	3	31	0	1	0	1	0	0	0	1	0	0	1	3
15	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	1	1
16	9	9	0	3	1	28	1	1	0	0	1	1	0	0	0	0	1	1
17	0	6	0	0	0	6	0	1	0	1	0	0	1	0	0	1	0	20
18	0	0	0	0	12	10	0	1	0	1	0	0	0	1	0	1	0	12
19	7	6	0	4	4	26	1	0	0	0	1	1	0	0	0	0	1	1
20	4	2	0	0	5	17	0	0	1	0	0	0	1	0	0	1	0	18
21	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	1	0	4
22	0	0	0	0	0	0	1	1	0	1	0	0	0	1	0	1	0	9
23	0	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0	1	2
24	0	12	0	0	5	26	1	1	0	1	0	0	0	1	0	1	0	3
25	5	3	0	0	5	31	1	1	0	1	0	1	0	0	0	0	1	2
26	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	9
27	14	3	8	5	2	41	1	1	0	1	0	0	1	0	0	0	1	1
28	0	2	0	0	1	5	1	1	0	0	1	0	0	1	0	0	1	1
29	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	1	1
30	15	8	13	0	2	48	1	1	0	1	0	0	0	1	0	1	0	2
31	0	5	0	41	4	59	1	1	0	0	1	0	1	0	0	0	1	1
32	10	8	3	23	20	89	0	0	0	1	0	0	1	0	0	1	0	231
33	12	14	2	0	10	40	1	1	0	1	0	0	1	0	0	1	0	4
34	1	3	15	40	2	64	0	1	0	1	0	0	1	0	0	0	1	7
35	6	9	0	0	0	15	1	1	0	0	1	0	0	1	0	0	1	1
36	51	15	0	27	1	106	1	0	0	1	0	0	1	0	0	1	0	26
37	8	10	0	0	5	34	0	1	0	1	0	1	0	0	0	0	1	3
38	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	1	0	2
39	0	2	0	7	2	14	1	1	0	1	0	0	1	0	0	0	1	3
40	3	0	0	0	0	3	1	1	0	0	1	1	0	0	0	0	1	1
41	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	0	1	3
42	7	10	1	3	5	34	0	1	0	0	1	0	0	1	0	1	0	1
43	15	7	3	0	5	33	0	0	0	1	0	0	1	0	0	1	0	8
44	0	7	7	0	23	26	0	0	0	1	0	0	0	1	0	1	0	19
45	0	0	0	0	5	8	1	1	1	0	0	0	0	1	0	0	1	6
46	5	7	0	6	1	24	0	0	0	1	0	0	1	0	0	1	0	164
47	48	5	0	1	1	59	0	1	1	0	0	0	0	1	0	0	1	7
48	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	0	1	5

OBS	ESPHYRSKMEA	ESMSDRSKMEA	ESPSYRSKMEA	ESCHERSKMEA	ESOTHRSKFAC	ESTOTRSKMEA	ESRSKPREV	ESHEAPROM	ESHEASHA	ESHEAEXT	ESHEAINT	ESPRSE	ESSESE	ESTESE	ESSAFINT	ESSAFEXT	ESSAFSHA	TWRA
49	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	5
50	10	10	1	0	3	36	1	0	0	0	1	0	0	1	0	0	1	1
51	4	7	0	3	3	27	1	1	0	1	0	0	0	1	0	1	0	2
52	0	7	0	0	40	78	1	1	1	0	0	0	1	0	0	0	1	5
53	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	1	0	4
54	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	1	1
55	0	5	0	0	5	24	1	1	1	0	0	0	1	0	0	0	1	3
56	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	55
57	16	12	3	20	30	76	0	1	0	1	0	0	1	0	0	0	1	11
58	2	0	0	0	0	2	0	1	0	1	0	0	1	0	0	1	0	16
59	7	0	0	0	10	13	1	1	0	1	0	0	1	0	0	1	0	21
60	0	0	0	0	0	0	1	1	0	1	0	0	0	1	0	1	0	74
61	0	6	0	0	2	14	1	1	0	0	1	1	0	0	0	1	0	1
62	6	2	0	6	0	14	0	0	0	1	0	0	1	0	0	1	0	44
63	8	5	2	8	3	40	1	1	0	1	0	0	1	0	1	0	0	2
64	23	1	0	0	1	25	1	0	0	1	0	0	1	0	0	1	0	9
65	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	0	1	3
66	0	0	0	0	0	0	1	1	0	1	0	0	0	1	0	0	1	3
67	1	0	0	0	0	1	0	1	0	1	0	0	1	0	0	1	0	30
68	15	13	3	12	5	70	1	0	0	1	0	0	1	0	0	0	1	46
69	5	0	0	42	0	47	0	0	0	1	0	0	1	0	0	1	0	101
70	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	1	0	177
71	0	10	0	0	2	19	1	1	1	0	0	1	0	0	0	0	1	1
72	12	0	0	100	20	145	0	1	0	0	1	0	1	0	0	1	0	8
73	9	11	0	7	4	36	1	0	0	1	0	0	1	0	0	0	1	3
74	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	1	13
75	1	0	0	2	0	3	0	0	0	1	0	0	1	0	0	0	1	4
76	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	1	4
77	0	3	0	0	0	3	0	0	0	1	0	0	0	1	0	0	1	6
78	0	0	0	0	0	0	1	1	0	0	1	0	1	0	0	0	1	1
79	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	2
80	5	9	8	0	2	31	1	1	0	1	0	0	0	1	0	0	1	2
81	0	0	0	0	2	9	1	1	0	1	0	0	0	1	0	1	0	2
82	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	10
83	3	1	0	0	4	7	0	0	0	1	0	0	1	0	0	1	0	199
84	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	28
85	7	6	3	120	0	136	1	1	1	0	0	0	1	0	0	0	1	2
86	30	0	10	0	20	63	1	0	0	1	0	1	0	0	0	0	1	9
87	4	7	0	0	3	22	1	1	0	0	1	0	1	0	0	0	1	1
88	25	6	3	38	0	73	0	0	0	0	1	0	0	1	0	1	0	11
89	6	0	0	0	0	6	0	0	1	0	0	0	0	1	0	1	0	15
90	5	0	0	0	0	5	1	1	0	0	1	0	0	1	0	0	1	1
91	23	0	0	0	0	23	0	1	0	1	0	0	0	1	0	1	0	111
92	0	10	0	0	0	10	0	1	0	1	0	0	1	0	0	1	0	26
93	0	8	0	0	0	8	1	0	0	1	0	0	1	0	0	1	0	14
94	4	0	0	0	0	4	1	1	0	0	1	0	1	0	0	0	1	1
95	1	13	9	0	50	105	1	1	0	1	0	0	0	1	0	1	0	5
96	45	3	0	12	3	68	0	1	0	1	0	0	0	1	0	0	1	9
97	0	0	0	0	0	0	1	1	0	1	0	0	0	1	0	1	0	80
98	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	30

Source: Own elaboration, based on the data collected by GEP through the 'Annex Zero' and Annex D' of the Annual Single Report on OSH Service Activities (see Annexes 1 and 2).

Appendix 4 - Sample measures of central tendency and dispersion

No.	Variable	Mean	Mode	Median	Std. Dev.	Relative Std. Dev.
1	TWRA	18.61	1	4	41.45	2.23
2	EMPERSER	266.41	3	37	610.58	2.29
3	EMUNIWRK	73.82	0	0	343.99	4.66
4	EMTEMP	5.47	0	0	22.97	4.20
5	EMBV	102,000,000	0	2,680,757	468,000,000	4.59
6	EMSC	20,785,163	5,000	124,170	130,000,000	6.25
7	EMNSC	86.14	100	100	34.19	0.40
8	EMFSC	6.71	0	0	24.40	3.63
9	EMCVT	386,175	0	33	3,216,538	8.33
10	EMCOSH	221,262	0	1,759	1,248,079	5.64
11	EMGVA	28,793,933	0	684,170	134,000,000	4.65
12	EMCPE	6,041,228	0	698,045	13,552,795	2.24
13	EMNP	7,967,473	0	580	40,557,268	5.09
14	EMMAXWKHR	469,436	0	74,104	1,086,862	2.32
15	EMHRPABS	15,022.71	0	0	49,398.31	3.29
16	EMHRNPABS	30,431.26	0	2,693	70,995.95	2.33
17.1	ESPRSE	0.11	0	0	0.32	2.83
17.2	ESSESE	0.51	1	1	0.50	0.98
17.3	ESTESE	0.38	0	0	0.49	1.29
18	ESAVEE	212.39	4	29	819.30	3.86
19	ESAVOTWRK	94.09	0	0	420.37	4.47
20	ESAVPERSER	306.48	4	31.50	1,002.28	3.27
21	ESHRWRK	246,059.80	11,616	47,507.50	683,261.30	2.78
22.1	ESSAFINT	0.01	0	0	0.10	9.90
22.2	ESSAFEXT	0.47	0	0	0.50	1.07
22.3	ESSAFSHA	0.52	1	1	0.50	0.96
23.1	ESHEAINT	0.20	0	0	0.41	1.98
23.2	ESHEAEXT	0.67	1	1	0.47	0.70
23.3	ESHEASHA	0.12	0	0	0.33	2.69
24	ESEMICYWRK	4.39	1	2	6.52	1.49
25	ESRSKPREV	0.59	1	1	0.49	0.83
26	ESHEAPROM	0.62	1	1	0.49	0.78
27	ESCOVINFOAC	0.54	1	0.48	0.43	0.80
28	ESCOVCONSAC	0.47	0	0.32	0.45	0.96
29	ESCOVTRAIAC	0.43	0	0.16	0.44	1.03
30	ESCOVHEAPRAC	0.37	0	0	0.94	2.56
31	ESPHYRSKFAC	11.37	0	1	32.74	2.88
32	ESCHERSKFAC	5.23	0	0	17.49	3.34
33	ESBIORSKFAC	0.09	0	0	0.32	3.53
34	ESMSDRSKFAC	5.36	0	1	17.60	3.29
35	ESPSYRSKFAC	0.48	0	0	1.38	2.88
36	ESOTHRSKFAC	3.96	0	1	8.44	2.13
37	ESPHYRSKMEA	5.53	0	1	9.87	1.78
38	ESCHERSKMEA	5.73	0	0	17.69	3.09
39	ESBIORSKMEA	0.20	0	0	0.85	4.16
40	ESMSDRSKMEA	4.02	0	2	5.11	1.27
41	ESPSYRSKMEA	0.98	0	0	2.74	2.79
42	ESOTHRSKMEA	7.80	0	1.50	13.41	1.72
43	ESTOTRSKMEA	24.27	0	13.50	30.69	1.26
44	ESCOVRSKMEA	1.55	0	1.06	1.70	1.09
45	ESCOVHEAEXA	0.74	0	0.67	0.77	1.05

Source: Based on the econometric program EViews 7 and own calculations.

Appendix 5 - Independent variable selection process (independent variables included and non-included in the unrestricted multiple linear regression model)

No.	Variable	Type	R	R ²	β	Std. Error	t	p-value	Notes
6	EMSC	Quantitative	0.2165	0.0469	0.0000	0.0000	8.7169	0.0000	Excluded in 2 nd phase: rejection firstly determined by serious collinearity with ESAVPERSER
34	ESMSDRSKFAC	Quantitative	0.5352	0.2864	1.2601	0.1766	7.1355	0.0000	Excluded in 2 nd phase: rejection firstly determined by serious collinearity with ESPHYRSKFAC
21	ESHRWRK	Quantitative	0.6747	0.4553	0.0000	0.0000	4.9420	0.0000	Excluded in 2 nd phase: rejection firstly determined by serious collinearity with ESAVPERSER
31	ESPHYRSKFAC	Quantitative	0.6317	0.3990	0.7997	0.1801	4.4399	0.0000	To be included in the model
23.1	ESHEAINT	ESORMOHEA dummy category	-0.2052	0.0421	-20.9974	5.2060	-4.0333	0.0001	To be included in the model
22.1	ESSAFINT	ESORMOSAF dummy category	-0.0409	0.0017	-16.7835	4.2485	-3.9505	0.0001	To be included in the model
29	ESCOVTRAIAC	Quantitative	-0.3332	0.1110	-31.4945	8.0497	-3.9125	0.0002	Excluded in 2 nd phase: rejection firstly determined by serious collinearity with ESCOVINFOAC
27	ESCOVINFOAC	Quantitative	-0.3843	0.1477	-36.8012	9.4771	-3.8832	0.0002	To be included in the model
17.1	ESPRSE	ESACSE dummy category	-0.1409	0.0199	-18.4054	4.7429	-3.8806	0.0002	To be included in the model
44	ESCOVRSKMEA	Quantitative	-0.3165	0.1002	-7.7334	2.0181	-3.8321	0.0002	Excluded in 2 nd phase: rejection firstly determined by serious collinearity with ESCOVINFOAC
22.2	ESSAFEXT	ESORMOSAF dummy category	0.3777	0.1427	31.2124	8.2879	3.7660	0.0003	To be included in the model
22.3	ESSAFSHA	ESORMOSAF dummy reference category	-0.3691	0.1363	-30.4681	8.1463	-3.7401	0.0003	Excluded in 1 st phase: dummy reference category of ESORMOSAF
28	ESCOVCONSAC	Quantitative	-0.3513	0.1234	-32.3495	8.8493	-3.6556	0.0004	Excluded in 2 nd phase: rejection firstly determined by serious collinearity with ESCOVINFOAC
20	ESAVPERSER	Quantitative	0.7705	0.5937	0.0319	0.0088	3.6219	0.0005	To be included in the model
9	EMCVT	Quantitative	-0.0511	0.0026	0.0000	0.0000	-3.5314	0.0006	Excluded in 2 nd phase: rejection firstly determined by serious collinearity with ESCOVINFOAC
23.2	ESHEAEXT	ESORMOHEA dummy category	0.2462	0.0606	21.6506	6.1360	3.5285	0.0006	To be included in the model
18	ESAVEE	Quantitative	0.5981	0.3578	0.0303	0.0086	3.5022	0.0007	Excluded in 2 nd phase: rejection firstly determined by serious collinearity with ESAVPERSER
30	ESCOVHEAPRAC	Quantitative	-0.1410	0.0199	-6.1872	1.8539	-3.3374	0.0012	Excluded in 2 nd phase: rejection firstly determined by serious collinearity with ESCOVINFOAC
39	ESBIORSKMEA	Quantitative	-0.0762	0.0058	-3.7221	1.2144	-3.0649	0.0028	Excluded in 2 nd phase: rejection firstly determined by serious collinearity with ESCOVINFOAC
10	EMCOSH	Quantitative	-0.0729	0.0053	0.0000	0.0000	-2.6784	0.0087	Excluded in 2 nd phase: rejection firstly determined by serious collinearity with ESCOVINFOAC
12	EMCPER	Quantitative	0.3811	0.1452	0.0000	0.0000	2.5755	0.0115	Excluded in 2 nd phase: rejection firstly determined by serious collinearity with ESAVPERSER
45	ESCOVHEAEXA	Quantitative	-0.1911	0.0365	-10.2333	4.0227	-2.5439	0.0126	Excluded in 2 nd phase: rejection firstly determined by serious collinearity with ESPHYRSKFAC
19	ESAVOTWRK	Quantitative	0.6713	0.4507	0.0662	0.0263	2.5200	0.0134	To be included in the model
16	EMHRNPABS	Quantitative	0.2918	0.0851	0.0002	0.0001	2.3562	0.0205	Excluded in 2 nd phase: rejection

No.	Variable	Type	R	R ²	β	Std. Error	t	p-value	Notes
23.3	ESHEASHA	ESORMOHEA dummy reference category	-0.0999	0.0100	-12.5678	5.3805	-2.3358	0.0216	firstly determined by serious collinearity with ESAVPERSER Excluded in 1 st phase in spite of p-value < 0.05: dummy reference category of ESORMOHEA
25	ESRSKPREV	Dummy	-0.2570	0.0661	-21.5647	9.2400	-2.3338	0.0217	To be included in the model
26	ESHEAPROM	Dummy	-0.2779	0.0772	-23.6358	10.1845	-2.3208	0.0224	To be included in the model
4	EMTEMP	Quantitative	0.2980	0.0888	0.5377	0.2721	1.9760	0.0510	Excluded in 1 st phase: p-value > 0.05
2	EMBERSER	Quantitative	0.3313	0.1098	0.0225	0.0122	1.8480	0.0677	Excluded in 1 st phase: p-value > 0.05
14	EMMAXWKHR	Quantitative	0.2616	0.0685	0.0000	0.0000	1.7778	0.0786	Excluded in 1 st phase: p-value > 0.05
8	EMFSC	Quantitative	0.2382	0.0568	0.4046	0.2348	1.7236	0.0880	Excluded in 1 st phase: p-value > 0.05
7	EMNSC	Quantitative	-0.2623	0.0688	-0.3180	0.1995	-1.5940	0.1142	Excluded in 1 st phase: p-value > 0.05
32	ESCHERSKFAC	Quantitative	0.3559	0.1267	0.8434	0.5331	1.5820	0.1169	Excluded in 1 st phase: p-value > 0.05
24	ESEMCYWRK	Quantitative	0.4213	0.1775	2.6790	1.7235	1.5544	0.1234	Excluded in 1 st phase: p-value > 0.05
35	ESPSYRSKFAC	Quantitative	-0.0543	0.0029	-1.6306	1.2240	-1.3322	0.1860	Excluded in 1 st phase: p-value > 0.05
11	EMGVA	Quantitative	0.1451	0.0211	0.0000	0.0000	1.2151	0.2273	Excluded in 1 st phase: p-value > 0.05
17.2	ESSESE	ESACSE dummy category	0.1051	0.0111	8.6725	8.3065	1.0441	0.2991	To be included in the model in spite of p-value > 0.05: dummy category of ESACSE
33	ESBIORSKFAC	Quantitative	0.1716	0.0295	21.9679	21.2045	1.0360	0.3028	Excluded in 1 st phase: p-value > 0.05
13	EMNP	Quantitative	0.1095	0.0120	0.0000	0.0000	0.9087	0.3658	Excluded in 1 st phase: p-value > 0.05
40	ESMSDRSKMEA	Quantitative	-0.0681	0.0046	-0.5527	0.6122	-0.9027	0.3689	Excluded in 1 st phase: p-value > 0.05
15	EMHRPABS	Quantitative	0.1098	0.0121	0.0001	0.0001	0.8677	0.3877	Excluded in 1 st phase: p-value > 0.05
41	ESPSYRSKMEA	Quantitative	-0.0381	0.0015	-0.5769	0.8174	-0.7057	0.4821	Excluded in 1 st phase: p-value > 0.05
3	EMUNIWRK	Quantitative	0.0559	0.0031	0.0067	0.0096	0.7006	0.4853	Excluded in 1 st phase: p-value > 0.05
5	EMBV	Quantitative	0.0568	0.0032	0.0000	0.0000	0.6560	0.5134	Excluded in 1 st phase: p-value > 0.05
37	ESPHYRSKMEA	Quantitative	0.0396	0.0016	0.1663	0.2695	0.6172	0.5386	Excluded in 1 st phase: p-value > 0.05
38	ESCHERSKMEA	Quantitative	0.0539	0.0029	0.1262	0.2163	0.5834	0.5610	Excluded in 1 st phase: p-value > 0.05
43	ESTOTRSKMEA	Quantitative	0.0473	0.0022	0.0639	0.1710	0.3735	0.7096	Excluded in 1 st phase: p-value > 0.05
42	ESOTHSKMEA	Quantitative	0.0465	0.0022	0.1437	0.4844	0.2967	0.7673	Excluded in 1 st phase: p-value > 0.05
36	ESOTHSKFAC	Quantitative	0.0326	0.0011	0.1599	0.5525	0.2894	0.7729	Excluded in 1 st phase: p-value > 0.05
17.3	ESTESE	ESACSE dummy reference category	-0.0167	0.0003	-1.4178	8.2370	-0.1721	0.8637	Excluded in 1 st phase: dummy reference category of ESACSE

Source: Own elaboration on the basis of the EVIEWS 7 outputs of the results of the simple linear regressions between each variable and the dependent variable, as well as of the correlation coefficients between these variables and between each one of these variables and the dependent variable.

Notes:

1. The variables are arranged in ascending order of the respective p-value.
2. Shaded in grey variables were excluded from future consideration in the first or second stage of the selection process, for the reasons highlighted in the last column of the Table. As such, they were not included in the model.

Appendix 6 - EViews 7 outputs

Appendix 6.1 - Simple linear regressions between each independent variable and the dependent variable (TAW)

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:41

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMBV	5.03E-09	7.67E-09	0.656024	0.5134
C	18.09707	4.210015	4.298575	0.0000
R-squared	0.003224	Mean dependent var		18.61224
Adjusted R-squared	-0.007159	S.D. dependent var		41.44842
S.E. of regression	41.59653	Akaike info criterion		10.31411
Sum squared resid	166106.0	Schwarz criterion		10.36686
Log likelihood	-503.3913	Hannan-Quinn criter.		10.33545
F-statistic	0.310493	Durbin-Watson stat		1.857521
Prob(F-statistic)	0.578675			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:43

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMCOSH	-2.42E-06	9.04E-07	-2.678374	0.0087
C	19.14817	4.324841	4.427485	0.0000
R-squared	0.005319	Mean dependent var		18.61224
Adjusted R-squared	-0.005042	S.D. dependent var		41.44842
S.E. of regression	41.55278	Akaike info criterion		10.31200
Sum squared resid	165756.8	Schwarz criterion		10.36476
Log likelihood	-503.2881	Hannan-Quinn criter.		10.33334
F-statistic	0.513391	Durbin-Watson stat		1.819586
Prob(F-statistic)	0.475414			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:45

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMCPER	1.17E-06	4.53E-07	2.575528	0.0115
C	11.57146	3.154214	3.668572	0.0004
R-squared	0.145222	Mean dependent var		18.61224

Adjusted R-squared	0.136318	S.D. dependent var	41.44842
S.E. of regression	38.51987	Akaike info criterion	10.16042
Sum squared resid	142442.9	Schwarz criterion	10.21318
Log likelihood	-495.8607	Hannan-Quinn criter.	10.18176
F-statistic	16.30990	Durbin-Watson stat	2.011014
Prob(F-statistic)	0.000108		

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:45

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMCVT	-6.58E-07	1.86E-07	-3.531441	0.0006
C	18.86652	4.262739	4.425914	0.0000

R-squared	0.002611	Mean dependent var	18.61224
Adjusted R-squared	-0.007779	S.D. dependent var	41.44842
S.E. of regression	41.60931	Akaike info criterion	10.31472
Sum squared resid	166208.2	Schwarz criterion	10.36748
Log likelihood	-503.4214	Hannan-Quinn criter.	10.33606
F-statistic	0.251307	Durbin-Watson stat	1.824459
Prob(F-statistic)	0.617304		

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:47

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMFSC	0.404624	0.234759	1.723575	0.0880
C	15.89548	4.081407	3.894609	0.0002

R-squared	0.056757	Mean dependent var	18.61224
Adjusted R-squared	0.046931	S.D. dependent var	41.44842
S.E. of regression	40.46412	Akaike info criterion	10.25891
Sum squared resid	157185.1	Schwarz criterion	10.31166
Log likelihood	-500.6864	Hannan-Quinn criter.	10.28024
F-statistic	5.776516	Durbin-Watson stat	1.876425
Prob(F-statistic)	0.018163		

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:47

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMGVA	4.48E-08	3.69E-08	1.215091	0.2273
C	17.32169	4.172739	4.151156	0.0001

R-squared	0.021055	Mean dependent var	18.61224
Adjusted R-squared	0.010858	S.D. dependent var	41.44842
S.E. of regression	41.22280	Akaike info criterion	10.29606
Sum squared resid	163134.6	Schwarz criterion	10.34881
Log likelihood	-502.5068	Hannan-Quinn criter.	10.31739
F-statistic	2.064740	Durbin-Watson stat	1.851822
Prob(F-statistic)	0.153992		

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:49

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMHRNPABS	0.000170	7.23E-05	2.356228	0.0205
C	13.42819	3.560956	3.770951	0.0003

R-squared	0.085143	Mean dependent var	18.61224
Adjusted R-squared	0.075614	S.D. dependent var	41.44842
S.E. of regression	39.85059	Akaike info criterion	10.22835
Sum squared resid	152454.7	Schwarz criterion	10.28110
Log likelihood	-499.1891	Hannan-Quinn criter.	10.24969
F-statistic	8.934472	Durbin-Watson stat	2.019272
Prob(F-statistic)	0.003554		

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:49

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMHRPABS	9.21E-05	0.000106	0.867686	0.3877
C	17.22851	4.068185	4.234938	0.0001

R-squared	0.012051	Mean dependent var	18.61224
Adjusted R-squared	0.001760	S.D. dependent var	41.44842
S.E. of regression	41.41194	Akaike info criterion	10.30521
Sum squared resid	164635.1	Schwarz criterion	10.35797
Log likelihood	-502.9554	Hannan-Quinn criter.	10.32655
F-statistic	1.170995	Durbin-Watson stat	1.900096
Prob(F-statistic)	0.281908		

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:50

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMMAXWKHR	9.98E-06	5.61E-06	1.777812	0.0786
C	13.92836	3.605699	3.862873	0.0002

R-squared	0.068453	Mean dependent var	18.61224
Adjusted R-squared	0.058750	S.D. dependent var	41.44842
S.E. of regression	40.21246	Akaike info criterion	10.24643
Sum squared resid	155236.0	Schwarz criterion	10.29918
Log likelihood	-500.0750	Hannan-Quinn criter.	10.26777
F-statistic	7.054398	Durbin-Watson stat	1.892928
Prob(F-statistic)	0.009259		

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:51

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMNP	1.12E-07	1.23E-07	0.908670	0.3658
C	17.72089	4.243816	4.175699	0.0001

R-squared	0.011983	Mean dependent var	18.61224
Adjusted R-squared	0.001691	S.D. dependent var	41.44842
S.E. of regression	41.41335	Akaike info criterion	10.30528
Sum squared resid	164646.3	Schwarz criterion	10.35804
Log likelihood	-502.9588	Hannan-Quinn criter.	10.32662
F-statistic	1.164350	Durbin-Watson stat	1.848729
Prob(F-statistic)	0.283269		

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:52

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMNSC	-0.317955	0.199470	-1.593997	0.1142
C	46.00181	19.56472	2.351263	0.0208

R-squared	0.068777	Mean dependent var	18.61224
Adjusted R-squared	0.059077	S.D. dependent var	41.44842
S.E. of regression	40.20547	Akaike info criterion	10.24608
Sum squared resid	155182.1	Schwarz criterion	10.29883
Log likelihood	-500.0579	Hannan-Quinn criter.	10.26742
F-statistic	7.090216	Durbin-Watson stat	1.859767
Prob(F-statistic)	0.009089		

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:53

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMPERSER	0.022489	0.012170	1.847974	0.0677

C	12.62086	3.348602	3.768993	0.0003
R-squared	0.109758	Mean dependent var		18.61224
Adjusted R-squared	0.100484	S.D. dependent var		41.44842
S.E. of regression	39.31085	Akaike info criterion		10.20107
Sum squared resid	148352.9	Schwarz criterion		10.25383
Log likelihood	-497.8527	Hannan-Quinn criter.		10.22241
F-statistic	11.83581	Durbin-Watson stat		1.883687
Prob(F-statistic)	0.000862			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:53

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMSC	6.88E-08	7.90E-09	8.716949	0.0000
C	17.18137	4.192491	4.098128	0.0001
R-squared	0.046871	Mean dependent var		18.61224
Adjusted R-squared	0.036942	S.D. dependent var		41.44842
S.E. of regression	40.67562	Akaike info criterion		10.26933
Sum squared resid	158832.6	Schwarz criterion		10.32209
Log likelihood	-501.1973	Hannan-Quinn criter.		10.29067
F-statistic	4.720870	Durbin-Watson stat		1.837616
Prob(F-statistic)	0.032260			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:54

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMTEMP	0.537708	0.272118	1.976010	0.0510
C	15.67131	4.033405	3.885379	0.0002
R-squared	0.088785	Mean dependent var		18.61224
Adjusted R-squared	0.079294	S.D. dependent var		41.44842
S.E. of regression	39.77119	Akaike info criterion		10.22436
Sum squared resid	151847.8	Schwarz criterion		10.27711
Log likelihood	-498.9936	Hannan-Quinn criter.		10.24570
F-statistic	9.353893	Durbin-Watson stat		1.953414
Prob(F-statistic)	0.002883			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:55

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.

EMUNIWRK	0.006733	0.009611	0.700559	0.4853
C	18.11521	4.151835	4.363181	0.0000
R-squared	0.003123	Mean dependent var		18.61224
Adjusted R-squared	-0.007261	S.D. dependent var		41.44842
S.E. of regression	41.59864	Akaike info criterion		10.31421
Sum squared resid	166122.9	Schwarz criterion		10.36696
Log likelihood	-503.3962	Hannan-Quinn criter.		10.33555
F-statistic	0.300722	Durbin-Watson stat		1.855908
Prob(F-statistic)	0.584703			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:56

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESAVEE	0.030259	0.008640	3.502238	0.0007
C	12.18553	3.036835	4.012575	0.0001
R-squared	0.357759	Mean dependent var		18.61224
Adjusted R-squared	0.351069	S.D. dependent var		41.44842
S.E. of regression	33.38929	Akaike info criterion		9.874545
Sum squared resid	107025.1	Schwarz criterion		9.927299
Log likelihood	-481.8527	Hannan-Quinn criter.		9.895883
F-statistic	53.47663	Durbin-Watson stat		2.100338
Prob(F-statistic)	0.000000			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:56

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESAVOTWRK	0.066193	0.026267	2.519991	0.0134
C	12.38406	2.550605	4.855340	0.0000
R-squared	0.450674	Mean dependent var		18.61224
Adjusted R-squared	0.444952	S.D. dependent var		41.44842
S.E. of regression	30.87971	Akaike info criterion		9.718273
Sum squared resid	91541.43	Schwarz criterion		9.771027
Log likelihood	-474.1954	Hannan-Quinn criter.		9.739611
F-statistic	78.75971	Durbin-Watson stat		1.744881
Prob(F-statistic)	0.000000			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:57

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.

ESAVPERSER	0.031863	0.008797	3.621889	0.0005
C	8.846914	2.126985	4.159368	0.0001
R-squared	0.593657	Mean dependent var		18.61224
Adjusted R-squared	0.589425	S.D. dependent var		41.44842
S.E. of regression	26.55856	Akaike info criterion		9.416778
Sum squared resid	67714.28	Schwarz criterion		9.469533
Log likelihood	-459.4221	Hannan-Quinn criter.		9.438116
F-statistic	140.2538	Durbin-Watson stat		2.135289
Prob(F-statistic)	0.000000			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:57

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESBIORSKFAC	21.96790	21.20452	1.036001	0.3028
C	16.59478	4.303653	3.855977	0.0002
R-squared	0.029462	Mean dependent var		18.61224
Adjusted R-squared	0.019352	S.D. dependent var		41.44842
S.E. of regression	41.04541	Akaike info criterion		10.28743
Sum squared resid	161733.7	Schwarz criterion		10.34019
Log likelihood	-502.0842	Hannan-Quinn criter.		10.30877
F-statistic	2.914185	Durbin-Watson stat		1.847825
Prob(F-statistic)	0.091036			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:58

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESBIORSKMEA	-3.722125	1.214441	-3.064888	0.0028
C	19.37186	4.440445	4.362595	0.0000
R-squared	0.005813	Mean dependent var		18.61224
Adjusted R-squared	-0.004543	S.D. dependent var		41.44842
S.E. of regression	41.54247	Akaike info criterion		10.31151
Sum squared resid	165674.6	Schwarz criterion		10.36426
Log likelihood	-503.2638	Hannan-Quinn criter.		10.33284
F-statistic	0.561292	Durbin-Watson stat		1.832135
Prob(F-statistic)	0.455572			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 16:59

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESCHERSKFAC	0.843359	0.533081	1.582046	0.1169
C	14.19752	3.917556	3.624076	0.0005
R-squared	0.126693	Mean dependent var		18.61224
Adjusted R-squared	0.117596	S.D. dependent var		41.44842
S.E. of regression	38.93514	Akaike info criterion		10.18187
Sum squared resid	145530.7	Schwarz criterion		10.23462
Log likelihood	-496.9115	Hannan-Quinn criter.		10.20321
F-statistic	13.92700	Durbin-Watson stat		1.900793
Prob(F-statistic)	0.000322			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:00

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESCHERSKMEA	0.126211	0.216320	0.583447	0.5610
C	17.88846	4.062832	4.402955	0.0000
R-squared	0.002903	Mean dependent var		18.61224
Adjusted R-squared	-0.007483	S.D. dependent var		41.44842
S.E. of regression	41.60322	Akaike info criterion		10.31443
Sum squared resid	166159.5	Schwarz criterion		10.36718
Log likelihood	-503.4070	Hannan-Quinn criter.		10.33577
F-statistic	0.279494	Durbin-Watson stat		1.861382
Prob(F-statistic)	0.598253			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:00

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESCOVCONSAC	-32.34953	8.849306	-3.655601	0.0004
C	33.83547	8.010549	4.223864	0.0001
R-squared	0.123400	Mean dependent var		18.61224
Adjusted R-squared	0.114268	S.D. dependent var		41.44842
S.E. of regression	39.00848	Akaike info criterion		10.18563
Sum squared resid	146079.5	Schwarz criterion		10.23839
Log likelihood	-497.0960	Hannan-Quinn criter.		10.20697
F-statistic	13.51399	Durbin-Watson stat		1.989538
Prob(F-statistic)	0.000390			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:01

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESCOVHEAEXA	-10.23334	4.022663	-2.543923	0.0126
C	26.16124	6.741184	3.880807	0.0002
R-squared	0.036508	Mean dependent var		18.61224
Adjusted R-squared	0.026472	S.D. dependent var		41.44842
S.E. of regression	40.89613	Akaike info criterion		10.28015
Sum squared resid	160559.4	Schwarz criterion		10.33290
Log likelihood	-501.7271	Hannan-Quinn criter.		10.30148
F-statistic	3.637609	Durbin-Watson stat		1.865600
Prob(F-statistic)	0.059477			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:02

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESCOVHEAPRAC	-6.187233	1.853924	-3.337372	0.0012
C	20.89054	4.749903	4.398097	0.0000
R-squared	0.019876	Mean dependent var		18.61224
Adjusted R-squared	0.009667	S.D. dependent var		41.44842
S.E. of regression	41.24760	Akaike info criterion		10.29726
Sum squared resid	163331.0	Schwarz criterion		10.35001
Log likelihood	-502.5657	Hannan-Quinn criter.		10.31860
F-statistic	1.946831	Durbin-Watson stat		1.752808
Prob(F-statistic)	0.166148			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:03

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESCOVINFOAC	-36.80121	9.477080	-3.883181	0.0002
C	38.48216	8.650911	4.448336	0.0000
R-squared	0.147699	Mean dependent var		18.61224
Adjusted R-squared	0.138820	S.D. dependent var		41.44842
S.E. of regression	38.46404	Akaike info criterion		10.15752
Sum squared resid	142030.3	Schwarz criterion		10.21028
Log likelihood	-495.7186	Hannan-Quinn criter.		10.17886
F-statistic	16.63620	Durbin-Watson stat		2.061332
Prob(F-statistic)	0.000094			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:03

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESCOVRSKMEA	-7.733445	2.018085	-3.832070	0.0002
C	30.61574	6.967990	4.393769	0.0000
R-squared	0.100166	Mean dependent var		18.61224
Adjusted R-squared	0.090793	S.D. dependent var		41.44842
S.E. of regression	39.52204	Akaike info criterion		10.21179
Sum squared resid	149951.2	Schwarz criterion		10.26455
Log likelihood	-498.3778	Hannan-Quinn criter.		10.23313
F-statistic	10.68638	Durbin-Watson stat		1.816476
Prob(F-statistic)	0.001499			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:05

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESCOVTRAIAC	-31.49452	8.049697	-3.912510	0.0002
C	32.02901	7.377766	4.341288	0.0000
R-squared	0.111048	Mean dependent var		18.61224
Adjusted R-squared	0.101789	S.D. dependent var		41.44842
S.E. of regression	39.28234	Akaike info criterion		10.19962
Sum squared resid	148137.8	Schwarz criterion		10.25238
Log likelihood	-497.7816	Hannan-Quinn criter.		10.22096
F-statistic	11.99239	Durbin-Watson stat		1.860937
Prob(F-statistic)	0.000800			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:05

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESEMICYWRK	2.678967	1.723478	1.554396	0.1234
C	6.857593	5.517503	1.242880	0.2169
R-squared	0.177492	Mean dependent var		18.61224
Adjusted R-squared	0.168924	S.D. dependent var		41.44842
S.E. of regression	37.78579	Akaike info criterion		10.12194
Sum squared resid	137065.5	Schwarz criterion		10.17469
Log likelihood	-493.9751	Hannan-Quinn criter.		10.14328
F-statistic	20.71612	Durbin-Watson stat		1.878627
Prob(F-statistic)	0.000016			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:06

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESHEAEXT	21.65057	6.135978	3.528462	0.0006
C	4.031250	1.122968	3.589818	0.0005
R-squared	0.060620	Mean dependent var		18.61224
Adjusted R-squared	0.050835	S.D. dependent var		41.44842
S.E. of regression	40.38116	Akaike info criterion		10.25480
Sum squared resid	156541.3	Schwarz criterion		10.30756
Log likelihood	-500.4852	Hannan-Quinn criter.		10.27614
F-statistic	6.195106	Durbin-Watson stat		1.772494
Prob(F-statistic)	0.014532			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:06

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESHEAINT	-20.99744	5.206003	-4.033312	0.0001
C	22.89744	5.173103	4.426248	0.0000
R-squared	0.042116	Mean dependent var		18.61224
Adjusted R-squared	0.032138	S.D. dependent var		41.44842
S.E. of regression	40.77696	Akaike info criterion		10.27431
Sum squared resid	159625.0	Schwarz criterion		10.32706
Log likelihood	-501.4411	Hannan-Quinn criter.		10.29565
F-statistic	4.220865	Durbin-Watson stat		1.861641
Prob(F-statistic)	0.042647			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:07

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESHEAPROM	-23.63580	10.18447	-2.320769	0.0224
C	33.32432	9.866754	3.377435	0.0011
R-squared	0.077207	Mean dependent var		18.61224
Adjusted R-squared	0.067595	S.D. dependent var		41.44842
S.E. of regression	40.02306	Akaike info criterion		10.23699
Sum squared resid	153777.2	Schwarz criterion		10.28974
Log likelihood	-499.6123	Hannan-Quinn criter.		10.25832
F-statistic	8.032031	Durbin-Watson stat		1.720891
Prob(F-statistic)	0.005603			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:07

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESHEASHA	-12.56783	5.380549	-2.335789	0.0216
C	20.15116	4.759062	4.234272	0.0001
R-squared	0.009981	Mean dependent var		18.61224
Adjusted R-squared	-0.000331	S.D. dependent var		41.44842
S.E. of regression	41.45529	Akaike info criterion		10.30731
Sum squared resid	164980.0	Schwarz criterion		10.36006
Log likelihood	-503.0580	Hannan-Quinn criter.		10.32864
F-statistic	0.967864	Durbin-Watson stat		1.794980
Prob(F-statistic)	0.327686			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:08

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESHRWRK	4.09E-05	8.28E-06	4.941953	0.0000
C	8.540774	2.778964	3.073366	0.0028
R-squared	0.455263	Mean dependent var		18.61224
Adjusted R-squared	0.449588	S.D. dependent var		41.44842
S.E. of regression	30.75048	Akaike info criterion		9.709885
Sum squared resid	90776.81	Schwarz criterion		9.762640
Log likelihood	-473.7844	Hannan-Quinn criter.		9.731223
F-statistic	80.23171	Durbin-Watson stat		2.020030
Prob(F-statistic)	0.000000			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:08

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESMSDRSKFAC	1.260146	0.176603	7.135476	0.0000
C	11.86146	3.629685	3.267904	0.0015
R-squared	0.286413	Mean dependent var		18.61224
Adjusted R-squared	0.278979	S.D. dependent var		41.44842
S.E. of regression	35.19507	Akaike info criterion		9.979886
Sum squared resid	118914.5	Schwarz criterion		10.03264
Log likelihood	-487.0144	Hannan-Quinn criter.		10.00122
F-statistic	38.53154	Durbin-Watson stat		1.920342
Prob(F-statistic)	0.000000			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:14

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESMSDRSKMEA	-0.552667	0.612239	-0.902698	0.3689
C	20.83419	5.018424	4.151541	0.0001
R-squared	0.004637	Mean dependent var		18.61224
Adjusted R-squared	-0.005731	S.D. dependent var		41.44842
S.E. of regression	41.56703	Akaike info criterion		10.31269
Sum squared resid	165870.5	Schwarz criterion		10.36544
Log likelihood	-503.3217	Hannan-Quinn criter.		10.33403
F-statistic	0.447242	Durbin-Watson stat		1.838330
Prob(F-statistic)	0.505253			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:14

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESOTHRSKFAC	0.159930	0.552546	0.289441	0.7729
C	17.97905	4.115158	4.368983	0.0000
R-squared	0.001060	Mean dependent var		18.61224
Adjusted R-squared	-0.009346	S.D. dependent var		41.44842
S.E. of regression	41.64165	Akaike info criterion		10.31628
Sum squared resid	166466.6	Schwarz criterion		10.36903
Log likelihood	-503.4975	Hannan-Quinn criter.		10.33761
F-statistic	0.101864	Durbin-Watson stat		1.843049
Prob(F-statistic)	0.750298			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:15

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESOTHRSKMEA	0.143723	0.484394	0.296707	0.7673
C	17.49179	4.666548	3.748336	0.0003
R-squared	0.002163	Mean dependent var		18.61224
Adjusted R-squared	-0.008231	S.D. dependent var		41.44842
S.E. of regression	41.61865	Akaike info criterion		10.31517
Sum squared resid	166282.8	Schwarz criterion		10.36793
Log likelihood	-503.4434	Hannan-Quinn criter.		10.33651
F-statistic	0.208123	Durbin-Watson stat		1.838811
Prob(F-statistic)	0.649273			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:15

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESPHYRSKFAC	0.799745	0.180126	4.439912	0.0000
C	9.521261	3.117432	3.054200	0.0029
R-squared	0.398996	Mean dependent var		18.61224
Adjusted R-squared	0.392736	S.D. dependent var		41.44842
S.E. of regression	32.29958	Akaike info criterion		9.808183
Sum squared resid	100153.3	Schwarz criterion		9.860937
Log likelihood	-478.6010	Hannan-Quinn criter.		9.829521
F-statistic	63.73273	Durbin-Watson stat		1.928317
Prob(F-statistic)	0.000000			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:16

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESPHYRSKMEA	0.166324	0.269493	0.617173	0.5386
C	17.69237	4.367440	4.050971	0.0001
R-squared	0.001568	Mean dependent var		18.61224
Adjusted R-squared	-0.008832	S.D. dependent var		41.44842
S.E. of regression	41.63106	Akaike info criterion		10.31577
Sum squared resid	166381.9	Schwarz criterion		10.36852
Log likelihood	-503.4726	Hannan-Quinn criter.		10.33711
F-statistic	0.150779	Durbin-Watson stat		1.857185
Prob(F-statistic)	0.698652			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/11/16 Time: 17:16

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESPRSE	-18.40543	4.742939	-3.880597	0.0002
C	20.67816	4.692706	4.406447	0.0000
R-squared	0.019851	Mean dependent var		18.61224
Adjusted R-squared	0.009641	S.D. dependent var		41.44842
S.E. of regression	41.24813	Akaike info criterion		10.29729
Sum squared resid	163335.2	Schwarz criterion		10.35004
Log likelihood	-502.5670	Hannan-Quinn criter.		10.31862
F-statistic	1.944328	Durbin-Watson stat		1.849198
Prob(F-statistic)	0.166418			

Dependent Variable: TWRA

Method: Least Squares
Date: 09/11/16 Time: 17:17
Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESPSYRSKFAC	-1.630580	1.223983	-1.332192	0.1860
C	19.39426	4.422236	4.385623	0.0000
R-squared	0.002943	Mean dependent var		18.61224
Adjusted R-squared	-0.007443	S.D. dependent var		41.44842
S.E. of regression	41.60239	Akaike info criterion		10.31439
Sum squared resid	166152.8	Schwarz criterion		10.36714
Log likelihood	-503.4051	Hannan-Quinn criter.		10.33573
F-statistic	0.283366	Durbin-Watson stat		1.846054
Prob(F-statistic)	0.595733			

Dependent Variable: TWRA

Method: Least Squares
Date: 09/11/16 Time: 17:17
Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESPSYRSKMEA	-0.576858	0.817435	-0.705693	0.4821
C	19.17733	4.331145	4.427774	0.0000
R-squared	0.001450	Mean dependent var		18.61224
Adjusted R-squared	-0.008952	S.D. dependent var		41.44842
S.E. of regression	41.63353	Akaike info criterion		10.31589
Sum squared resid	166401.7	Schwarz criterion		10.36864
Log likelihood	-503.4784	Hannan-Quinn criter.		10.33722
F-statistic	0.139368	Durbin-Watson stat		1.859067
Prob(F-statistic)	0.709733			

Dependent Variable: TWRA

Method: Least Squares
Date: 09/11/16 Time: 17:18
Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESRSKPREV	-21.56466	9.240011	-2.333834	0.0217
C	31.37500	8.529469	3.678424	0.0004
R-squared	0.066063	Mean dependent var		18.61224
Adjusted R-squared	0.056335	S.D. dependent var		41.44842
S.E. of regression	40.26401	Akaike info criterion		10.24899
Sum squared resid	155634.3	Schwarz criterion		10.30174
Log likelihood	-500.2005	Hannan-Quinn criter.		10.27033
F-statistic	6.790674	Durbin-Watson stat		1.886476
Prob(F-statistic)	0.010623			

Dependent Variable: TWRA
Method: Least Squares
Date: 09/11/16 Time: 17:18
Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESSAFEXT	31.21237	8.287868	3.766032	0.0003
C	3.961538	0.917939	4.315689	0.0000
R-squared	0.142692	Mean dependent var		18.61224
Adjusted R-squared	0.133762	S.D. dependent var		41.44842
S.E. of regression	38.57684	Akaike info criterion		10.16338
Sum squared resid	142864.5	Schwarz criterion		10.21613
Log likelihood	-496.0055	Hannan-Quinn criter.		10.18472
F-statistic	15.97848	Durbin-Watson stat		1.926716
Prob(F-statistic)	0.000126			

Dependent Variable: TWRA
Method: Least Squares
Date: 09/11/16 Time: 17:19
Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESSAFINT	-16.78351	4.248503	-3.950451	0.0001
C	18.78351	4.248503	4.421205	0.0000
R-squared	0.001673	Mean dependent var		18.61224
Adjusted R-squared	-0.008726	S.D. dependent var		41.44842
S.E. of regression	41.62887	Akaike info criterion		10.31566
Sum squared resid	166364.5	Schwarz criterion		10.36842
Log likelihood	-503.4674	Hannan-Quinn criter.		10.33700
F-statistic	0.160887	Durbin-Watson stat		1.844105
Prob(F-statistic)	0.689232			

Dependent Variable: TWRA
Method: Least Squares
Date: 09/11/16 Time: 17:19
Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESSAFSHA	-30.46809	8.146287	-3.740119	0.0003
C	34.46809	8.092438	4.259296	0.0000
R-squared	0.136253	Mean dependent var		18.61224
Adjusted R-squared	0.127255	S.D. dependent var		41.44842
S.E. of regression	38.72145	Akaike info criterion		10.17086
Sum squared resid	143937.7	Schwarz criterion		10.22362
Log likelihood	-496.3722	Hannan-Quinn criter.		10.19220
F-statistic	15.14359	Durbin-Watson stat		1.917408
Prob(F-statistic)	0.000184			

Dependent Variable: TWRA
Method: Least Squares
Date: 09/11/16 Time: 17:19
Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESSESE	8.672500	8.306514	1.044060	0.2991
C	14.18750	4.662455	3.042925	0.0030
R-squared	0.011053	Mean dependent var		18.61224
Adjusted R-squared	0.000752	S.D. dependent var		41.44842
S.E. of regression	41.43284	Akaike info criterion		10.30622
Sum squared resid	164801.3	Schwarz criterion		10.35898
Log likelihood	-503.0049	Hannan-Quinn criter.		10.32756
F-statistic	1.072962	Durbin-Watson stat		1.831056
Prob(F-statistic)	0.302880			

Dependent Variable: TWRA
Method: Least Squares
Date: 09/11/16 Time: 17:20
Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESTESE	-1.417811	8.237035	-0.172126	0.8637
C	19.14754	5.728509	3.342500	0.0012
R-squared	0.000278	Mean dependent var		18.61224
Adjusted R-squared	-0.010136	S.D. dependent var		41.44842
S.E. of regression	41.65795	Akaike info criterion		10.31706
Sum squared resid	166597.0	Schwarz criterion		10.36981
Log likelihood	-503.5359	Hannan-Quinn criter.		10.33840
F-statistic	0.026678	Durbin-Watson stat		1.845069
Prob(F-statistic)	0.870600			

Dependent Variable: TWRA
Method: Least Squares
Date: 09/11/16 Time: 17:20
Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESTOTRSKMEA	0.063859	0.170994	0.373455	0.7096
C	17.06270	5.065427	3.368462	0.0011
R-squared	0.002236	Mean dependent var		18.61224
Adjusted R-squared	-0.008157	S.D. dependent var		41.44842
S.E. of regression	41.61713	Akaike info criterion		10.31510
Sum squared resid	166270.6	Schwarz criterion		10.36785
Log likelihood	-503.4398	Hannan-Quinn criter.		10.33644
F-statistic	0.215140	Durbin-Watson stat		1.853721
Prob(F-statistic)	0.643818			

Appendix 6.2 - Correlation coefficients (r) between statistically significant quantitative independent variables and of these with the dependent variable

	TWRA	ESAV-PERSER	ESHRWRK	ESAV-OTWRK	ESPHY-RSKFAC	ESAVEE	ESMSD-RSKFAC	ESCOV-INFOAC	EMCPER	ESCOV-CONSAC	ESCOV-TRAIA	ESCOV-RSKMEA	EMHRNP-ABS	EMSC	ESCOV-HEAEXA	ESCOV-HEAPRAC	ESBIO-RSKMEA	EMCOSH	EMCVT
TWRA	1.000000	0.770492	0.674732	0.671323	0.631661	0.598130	0.535175	-0.384316	0.381080	-0.351283	-0.333239	-0.316491	0.291793	0.216497	-0.191072	-0.140984	-0.076242	-0.072934	-0.051097
ESAVPERSER	0.770492	1.000000	0.838869	0.605261	0.290298	0.912791	0.199389	-0.302406	0.461263	-0.255195	-0.242294	-0.220026	0.339147	0.360149	-0.101012	-0.100340	-0.034293	-0.038740	-0.023912
ESHRWRK	0.674732	0.838869	1.000000	0.262286	0.114908	0.891647	0.070785	-0.344634	0.511070	-0.271604	-0.251184	-0.235697	0.570070	0.031013	-0.083049	-0.103868	-0.016817	-0.048055	-0.031820
ESAVOTWRK	0.671323	0.605261	0.262286	1.000000	0.548074	0.227359	0.411005	-0.205658	0.397666	-0.188559	-0.184593	-0.154395	0.072913	0.769761	-0.089842	-0.073563	-0.027264	-0.020681	-0.006966
ESPHYRSKFAC	0.631661	0.290298	0.114908	0.548074	1.000000	0.073927	0.621045	-0.263890	0.193332	-0.273344	-0.246194	-0.195578	0.013970	0.277862	-0.200132	-0.087654	0.065153	-0.055356	-0.038088
ESAVEE	0.598130	0.912791	0.891647	0.227359	0.073927	1.000000	0.033042	-0.264426	0.360246	-0.215444	-0.201696	-0.189949	0.377481	0.045634	-0.077475	-0.085006	-0.027963	-0.036781	-0.025679
ESMSDRSKFAC	0.535175	0.199389	0.070785	0.411005	0.621045	0.033042	1.000000	-0.145649	0.043316	-0.172534	-0.137154	-0.108834	-0.002552	-0.035228	-0.114317	-0.066317	-0.000788	-0.049083	-0.035229
ESCOVINFOAC	-0.384316	-0.302406	-0.344634	-0.205658	-0.263890	-0.264426	-0.145649	1.000000	-0.211070	0.684171	0.541289	0.491616	-0.279157	-0.112768	0.071072	0.238116	-0.113689	0.165735	0.123010
EMCPER	0.381080	0.461263	0.511070	0.397666	0.193332	0.360246	0.043316	-0.211070	1.000000	-0.111961	-0.117038	-0.014959	0.662613	0.510197	0.010164	-0.030844	-0.033932	0.377107	0.409117
ESCOVCONSAC	-0.351283	-0.255195	-0.271604	-0.188559	-0.273344	-0.215444	-0.172534	0.684171	-0.111961	1.000000	0.523750	0.484377	-0.212058	-0.080887	0.238216	0.308377	0.030138	0.127604	0.101781
ESCOVTRAIA	-0.333239	-0.242294	-0.251184	-0.184593	-0.246194	-0.201696	-0.137154	0.541289	-0.117038	0.523750	1.000000	0.454372	-0.191877	-0.085853	0.242765	0.319418	0.050609	0.187600	0.148511
ESCOVRSKMEA	-0.316491	-0.220026	-0.235697	-0.154395	-0.195578	-0.189949	-0.108834	0.491616	-0.014959	0.484377	0.454372	1.000000	-0.127285	-0.045528	0.264933	0.387906	0.088830	0.192466	0.217111
EMHRNPABS	0.291793	0.339147	0.570070	0.072913	0.013970	0.377481	-0.002552	-0.279157	0.662613	-0.212058	-0.191877	-0.127285	1.000000	0.061153	0.003621	-0.052030	-0.011231	0.134719	0.146211
EMSC	0.216497	0.360149	0.031013	0.769761	0.277862	0.045634	-0.035228	-0.112768	0.510197	-0.080887	-0.085853	-0.045528	0.061153	1.000000	-0.020581	-0.041865	-0.022991	0.123007	0.140651
ESCOVHEAEXA	-0.191072	-0.101012	-0.083049	-0.089842	-0.200132	-0.077475	-0.114317	0.071072	0.010164	0.238216	0.242765	0.264933	0.003621	-0.020581	1.000000	0.393636	0.354394	0.079141	0.091274
ESCOVHEAPRAC	-0.140984	-0.100340	-0.103868	-0.073563	-0.087654	-0.085006	-0.066317	0.238116	-0.030844	0.308377	0.319418	0.387906	-0.052030	-0.041865	0.393636	1.000000	-0.037650	-0.031319	-0.035176
ESBIORSKMEA	-0.076242	-0.034293	-0.016817	-0.027264	0.065153	-0.027963	-0.000788	-0.113689	-0.033932	0.030138	0.050609	0.088830	-0.011231	-0.022991	0.354394	-0.037650	1.000000	-0.029006	-0.024539
EMCOSH	-0.072934	-0.038740	-0.048055	-0.020681	-0.055356	-0.036781	-0.049083	0.165735	0.377107	0.127604	0.187600	0.192466	0.134719	0.123007	0.079141	-0.031319	-0.029006	1.000000	0.923295
EMCVT	-0.051097	-0.023912	-0.031820	-0.006966	-0.038088	-0.025679	-0.035229	0.123010	0.409117	0.101781	0.148511	0.217111	0.146211	0.140651	0.091274	-0.035176	-0.024539	0.923295	1.000000

Appendix 6.3 - Unrestricted multiple linear regression model

Dependent Variable: TWRA

Method: Least Squares

Date: 09/13/16 Time: 19:37

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESPHYRSKFAC	0.459114	0.187907	2.443299	0.0166
ESHEAINT	-0.021686	4.131617	-0.005249	0.9958
ESSAFINT	-8.262467	4.988822	-1.656196	0.1014
ESCOVINFOAC	-1.034789	4.686930	-0.220782	0.8258
ESPRSE	2.804472	3.461039	0.810298	0.4200
ESSAFEXT	9.790588	3.188249	3.070835	0.0029
ESAVPERSER	0.023856	0.004387	5.437954	0.0000
ESHEAEXT	1.489895	3.575760	0.416665	0.6780
ESAVOTWRK	0.007652	0.021190	0.361117	0.7189
ESRSKPREV	-5.308550	4.142264	-1.281558	0.2035
ESHEAPROM	-3.197566	4.067471	-0.786131	0.4340
ESSESE	8.106063	4.482060	1.808557	0.0741
C	1.091969	5.016550	0.217673	0.8282
R-squared	0.813596	Mean dependent var		18.61224
Adjusted R-squared	0.787280	S.D. dependent var		41.44842
S.E. of regression	19.11665	Akaike info criterion		8.861986
Sum squared resid	31062.94	Schwarz criterion		9.204890
Log likelihood	-421.2373	Hannan-Quinn criter.		9.000684
F-statistic	30.91661	Durbin-Watson stat		2.276848
Prob(F-statistic)	0.000000			

Appendix 6.4 - Sequential process of removing non-significant variables out of the multiple linear regression model

Dependent Variable: TWRA

Method: Least Squares

Date: 09/13/16 Time: 21:39

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESPHYRSKFAC	0.459115	0.186794	2.457863	0.0160
ESSAFINT	-8.265027	4.894180	-1.688746	0.0949
ESCOVINFOAC	-1.039170	4.479486	-0.231984	0.8171
ESPRSE	2.802875	3.440370	0.814701	0.4175
ESSAFEXT	9.789593	3.210863	3.048898	0.0031
ESAVPERSER	0.023856	0.004362	5.469276	0.0000
ESHEAEXT	1.502583	2.739071	0.548574	0.5847
ESAVOTWRK	0.007651	0.021042	0.363605	0.7170
ESRSKPREV	-5.309535	4.120210	-1.288657	0.2010
ESHEAPROM	-3.196457	4.029520	-0.793260	0.4298
ESSESE	8.106583	4.441718	1.825101	0.0715
C	1.081759	4.530514	0.238772	0.8119
R-squared	0.813596	Mean dependent var		18.61224
Adjusted R-squared	0.789754	S.D. dependent var		41.44842
S.E. of regression	19.00518	Akaike info criterion		8.841578
Sum squared resid	31062.94	Schwarz criterion		9.158105
Log likelihood	-421.2373	Hannan-Quinn criter.		8.969607
F-statistic	34.12399	Durbin-Watson stat		2.276799
Prob(F-statistic)	0.000000			

Dependent Variable: TWRA

Method: Least Squares

Date: 09/13/16 Time: 21:40

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESPHYRSKFAC	0.461743	0.181387	2.545621	0.0127
ESSAFINT	-7.626100	2.971236	-2.566642	0.0120
ESPRSE	2.711996	3.471521	0.781212	0.4368
ESSAFEXT	10.01226	3.350292	2.988475	0.0036
ESAVPERSER	0.023970	0.004306	5.566790	0.0000
ESHEAEXT	1.581820	2.812095	0.562506	0.5752
ESAVOTWRK	0.007452	0.020680	0.360350	0.7195
ESRSKPREV	-5.587486	3.507727	-1.592908	0.1148
ESHEAPROM	-3.158354	4.017911	-0.786069	0.4340
ESSESE	8.124383	4.413810	1.840674	0.0691
C	0.452241	4.043728	0.111838	0.9112
R-squared	0.813521	Mean dependent var		18.61224
Adjusted R-squared	0.792087	S.D. dependent var		41.44842
S.E. of regression	18.89945	Akaike info criterion		8.821573
Sum squared resid	31075.47	Schwarz criterion		9.111723
Log likelihood	-421.2571	Hannan-Quinn criter.		8.938933

F-statistic	37.95405	Durbin-Watson stat	2.266546
Prob(F-statistic)	0.000000		

Dependent Variable: TWRA

Method: Least Squares

Date: 09/13/16 Time: 21:41

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESPHYRSKFAC	0.502260	0.153620	3.269485	0.0015
ESSAFINT	-7.104951	2.706536	-2.625109	0.0102
ESPRSE	2.956848	3.594761	0.822544	0.4130
ESSAFEXT	10.05804	3.417648	2.942970	0.0042
ESAVPERSER	0.025522	0.005107	4.997089	0.0000
ESHEAEXT	1.414292	2.808243	0.503622	0.6158
ESRSKPREV	-6.566671	4.415799	-1.487086	0.1406
ESHEAPROM	-2.185397	4.078283	-0.535862	0.5934
ESSESE	7.973937	4.391386	1.815813	0.0728
C	0.326360	4.145936	0.078718	0.9374

R-squared	0.810970	Mean dependent var	18.61224
Adjusted R-squared	0.791637	S.D. dependent var	41.44842
S.E. of regression	18.91987	Akaike info criterion	8.814754
Sum squared resid	31500.62	Schwarz criterion	9.078526
Log likelihood	-421.9229	Hannan-Quinn criter.	8.921444
F-statistic	41.94821	Durbin-Watson stat	2.305670
Prob(F-statistic)	0.000000		

Dependent Variable: TWRA

Method: Least Squares

Date: 09/13/16 Time: 21:42

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESPHYRSKFAC	0.502965	0.152341	3.301575	0.0014
ESSAFINT	-6.368646	1.988694	-3.202426	0.0019
ESPRSE	2.762540	3.595562	0.768319	0.4443
ESSAFEXT	10.42646	3.316642	3.143680	0.0023
ESAVPERSER	0.025551	0.005077	5.032489	0.0000
ESRSKPREV	-6.684189	4.298911	-1.554856	0.1235
ESHEAPROM	-2.381886	4.033572	-0.590515	0.5563
ESSESE	8.001576	4.369347	1.831298	0.0704
C	1.281061	3.347441	0.382699	0.7029

R-squared	0.810759	Mean dependent var	18.61224
Adjusted R-squared	0.793749	S.D. dependent var	41.44842
S.E. of regression	18.82375	Akaike info criterion	8.795459
Sum squared resid	31535.70	Schwarz criterion	9.032854
Log likelihood	-421.9775	Hannan-Quinn criter.	8.891480
F-statistic	47.66254	Durbin-Watson stat	2.306819
Prob(F-statistic)	0.000000		

Dependent Variable: TWRA
Method: Least Squares
Date: 09/13/16 Time: 21:42
Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESPHYRSKFAC	0.509901	0.148357	3.436984	0.0009
ESSAFINT	-6.904400	2.354727	-2.932145	0.0043
ESPRSE	2.960599	3.654900	0.810036	0.4201
ESSAFEXT	10.64419	3.340666	3.186247	0.0020
ESAVPERSER	0.025630	0.005035	5.090689	0.0000
ESRSKPREV	-7.123172	4.191460	-1.699449	0.0927
ESSESE	7.994040	4.392220	1.820045	0.0721
C	-0.159846	3.813786	-0.041913	0.9667
R-squared	0.810078	Mean dependent var		18.61224
Adjusted R-squared	0.795306	S.D. dependent var		41.44842
S.E. of regression	18.75256	Akaike info criterion		8.778646
Sum squared resid	31649.28	Schwarz criterion		8.989663
Log likelihood	-422.1536	Hannan-Quinn criter.		8.863998
F-statistic	54.83969	Durbin-Watson stat		2.313033
Prob(F-statistic)	0.000000			

Dependent Variable: TWRA
Method: Least Squares
Date: 09/13/16 Time: 21:43
Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESPHYRSKFAC	0.511028	0.148003	3.452822	0.0008
ESSAFINT	-7.070758	2.403767	-2.941532	0.0041
ESSAFEXT	10.43629	3.291968	3.170227	0.0021
ESAVPERSER	0.025536	0.004976	5.131956	0.0000
ESRSKPREV	-6.921767	4.064025	-1.703180	0.0919
ESSESE	7.295078	3.742301	1.949357	0.0543
C	0.524925	3.610058	0.145406	0.8847
R-squared	0.809654	Mean dependent var		18.61224
Adjusted R-squared	0.797104	S.D. dependent var		41.44842
S.E. of regression	18.67001	Akaike info criterion		8.760463
Sum squared resid	31719.81	Schwarz criterion		8.945104
Log likelihood	-422.2627	Hannan-Quinn criter.		8.835147
F-statistic	64.51297	Durbin-Watson stat		2.328333
Prob(F-statistic)	0.000000			

Appendix 6.5 - Resctricted multiple linear regression model

Dependent Variable: TWRA

Method: Least Squares

Date: 09/13/16 Time: 21:45

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESPHYRSKFAC	0.525782	0.150563	3.492099	0.0007
ESSAFINT	-9.101567	2.613574	-3.482421	0.0008
ESSAFEXT	12.38149	3.196669	3.873248	0.0002
ESAVPERSER	0.025439	0.005157	4.932954	0.0000
ESSESE	7.737859	3.806042	2.033046	0.0449
C	-4.827801	2.489222	-1.939482	0.0555
R-squared	0.803659	Mean dependent var		18.61224
Adjusted R-squared	0.792988	S.D. dependent var		41.44842
S.E. of regression	18.85842	Akaike info criterion		8.771066
Sum squared resid	32718.88	Schwarz criterion		8.929329
Log likelihood	-423.7822	Hannan-Quinn criter.		8.835080
F-statistic	75.31458	Durbin-Watson stat		2.334332
Prob(F-statistic)	0.000000			

Appendix 6.6 - Ramsey Regression Equation Specification Error Test

Ramsey RESET Test

Equation: RESET

Specification: TWRA ESPHYRSKFAC ESSAFINT ESSAFEXT

ESAVPERSER ESSESE C

Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.063956	91	0.2902
F-statistic	1.132002	(1, 91)	0.2902
Likelihood ratio	1.211559	1	0.2710

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	402.0084	1	402.0084
Restricted SSR	32718.88	92	355.6400
Unrestricted SSR	32316.87	91	355.1305
Unrestricted SSR	32316.87	91	355.1305

LR test summary:

	Value	df
Restricted LogL	-423.7822	92
Unrestricted LogL	-423.1765	91

Unrestricted Test Equation:

Dependent Variable: TWRA

Method: Least Squares

Date: 09/13/16 Time: 22:31

Sample: 1 98

Included observations: 98

White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ESPHYRSKFAC	0.611380	0.229188	2.667587	0.0090
ESSAFINT	-10.61044	5.720353	-1.854858	0.0669
ESSAFEXT	11.86465	3.239679	3.662290	0.0004
ESAVPERSER	0.032453	0.019883	1.632206	0.1061
ESSESE	7.865140	3.833313	2.051787	0.0431
C	-5.521360	3.267885	-1.689582	0.0945
FITTED^2	-0.001305	0.003374	-0.386857	0.6998
R-squared	0.806072	Mean dependent var		18.61224
Adjusted R-squared	0.793285	S.D. dependent var		41.44842
S.E. of regression	18.84491	Akaike info criterion		8.779111
Sum squared resid	32316.87	Schwarz criterion		8.963752
Log likelihood	-423.1765	Hannan-Quinn criter.		8.853795
F-statistic	63.04086	Durbin-Watson stat		2.352584
Prob(F-statistic)	0.000000			

Appendix 7 - Analysis of serious collinearity between statistically significant quantitative independent variables

<i>r</i>	TWRA	ESAVPERSER	ESHRWRK	ESAVOTWRK	ESPHYRSKFAC	ESAVEE	ESMSDRSKFAC	ESCOVINFOAC	EMCPER	ESCOVCONSAC	ESCOVTRAIAC	ESCOVRSKMEA	EMHRNPABS	EMSC	ESCOVHEAEXA	ESCOVHEAPRAC	ESBIORSKMEA	EMCOSHMH	EMCVT
TWRA	1.0000	0.7705	0.6747	0.6713	0.6317	0.5981	0.5352	-0.3843	0.3811	-0.3513	-0.3332	-0.3165	0.2918	0.2165	-0.1911	-0.1410	-0.0762	-0.0729	-0.0511
ESAVPERSER	0.7705	1.0000	0.8389	0.6053	0.2903	0.9128	0.1994	-0.3024	0.4613	-0.2552	-0.2423	-0.2200	0.3391	0.3601	-0.1010	-0.1003	-0.0343	-0.0387	-0.0239
ESHRWRK	0.6747		1.0000	0.2623	0.1149	0.8916	0.0708	-0.3446	0.5111	-0.2716	-0.2512	-0.2357	0.5701	0.0310	-0.0830	-0.1039	-0.0168	-0.0481	-0.0318
ESAVOTWRK	0.6713			1.0000	0.5481	0.2274	0.4110	-0.2057	0.3977	-0.1886	-0.1846	-0.1544	0.0729	0.7698	-0.0898	-0.0736	-0.0273	-0.0207	-0.0070
ESPHYRSKFAC	0.6317				1.0000	0.0739	0.6210	-0.2639	0.1933	-0.2733	-0.2462	-0.1956	0.0140	0.2779	-0.2001	-0.0877	0.0652	-0.0554	-0.0381
ESAVEE	0.5981					1.0000	0.0330	-0.2644	0.3602	-0.2154	-0.2017	-0.1899	0.3775	0.0456	-0.0775	-0.0850	-0.0280	-0.0368	-0.0257
ESMSDRSKFAC	0.5352						1.0000	-0.1456	0.0433	-0.1725	-0.1372	-0.1088	-0.0026	-0.0352	-0.1143	-0.0663	-0.0008	-0.0491	-0.0352
ESCOVINFOAC	-0.3843							1.0000	-0.2111	0.6842	0.5413	0.4916	-0.2792	-0.1128	0.0711	0.2381	-0.1137	0.1657	0.1230
EMCPER	0.3811								1.0000	-0.1120	-0.1170	-0.0150	0.6626	0.5102	0.0102	-0.0308	-0.0339	0.3771	0.4091
ESCOVCONSAC	-0.3513									1.0000	0.5238	0.4844	-0.2121	-0.0809	0.2382	0.3084	0.0301	0.1276	0.1018
ESCOVTRAIAC	-0.3332										1.0000	0.4544	-0.1919	-0.0859	0.2428	0.3194	0.0506	0.1876	0.1485
ESCOVRSKMEA	-0.3165											1.0000	-0.1273	-0.0455	0.2649	0.3879	0.0888	0.1925	0.2171
EMHRNPABS	0.2918												1.0000	0.0612	0.0036	-0.0520	-0.0112	0.1347	0.1462
EMSC	0.2165													1.0000	-0.0206	-0.0419	-0.0230	0.1230	0.1407
ESCOVHEAEXA	-0.1911														1.0000	0.3936	0.3544	0.0791	0.0913
ESCOVHEAPRAC	-0.1410															1.0000	-0.0377	-0.0313	-0.0352
ESBIORSKMEA	-0.0762																1.0000	-0.0290	-0.0245
EMCOSHMH	-0.0729																	1.0000	0.9233
EMCVT	-0.0511																		1.0000

Source: Own elaboration on the basis of the outputs of the econometric application EViews 7 regarding the correlation coefficients between these variables and between each of these variables and the dependent variable.

Notes:

1. The variables are arranged in descending order of value of the respective correlation coefficient with the dependent variable.
2. Numeric cells shaded in grey highlight the situations of serious collinearity. It points out the cases where the variables of the corresponding line and column present a correlation coefficient which is higher than the correlation coefficient that one (or both) have with the dependent variable.
3. Shaded variables in grey in the first row and column are the variables that were excluded due to serious collinearity with other variable(s).

Appendix 8 - ACT local branches input and output data for the DEA Resource Efficiency Model 1

ACT LOCAL BRANCHES	LI {I}	TO {I}	TA {I}	OA {I}	SRVCAR {I}	WRRAINQ {O}	SUSPNOT {O}	FINCOL {O}	INFRNOT {O}	IMPRNOT {O}	OTHNOT {O}	AREA {ON}	INSPVIS {O}	WRKCOVINS {O}	WRINFSRV {O}	PRINFSRV {O}	PHINFSRV {O}	COVINFAW {O}
1 Almada	11.00	3	10	1	4	11	9	500	316	447	158	360	1,339	5,147	294	5,623	2,302	9,332
2 Aveiro	14.00	9	6	0	6	18	15	1,577	136	510	51	1,804	1,592	14,320	1,217	20,989	4,726	29,402
3 Barreiro	5.00	3	6	1	3	5	6	733	265	539	140	440	798	8,932	287	6,737	300	7,946
4 Beja	11.00	6	5	0	6	17	8	772	264	85	42	13,851	430	3,070	416	1,911	2,423	5,508
5 Braga	17.00	9	6	4	4	14	10	896	248	328	78	1,838	1,454	10,889	441	14,432	2,183	18,127
6 Bragança	5.00	3	2	2	3	16	9	328	126	160	115	6,600	585	1,856	64	1,253	447	5,687
7 Caldas da Rainha	5.33	4	3	0	2	11	6	914	50	515	152	1,057	579	3,934	20	3,328	49	5,931
8 Castelo Branco	6.00	2	3	1	4	11	6	359	203	354	412	5,089	716	2,966	80	2,194	739	4,168
9 Coimbra	14.67	14	7	3	5	11	26	585	342	400	155	2,976	1,087	10,706	856	8,511	4,325	22,758
10 Covilhã	5.00	1	1	0	2	11	4	276	112	185	79	1,939	602	7,164	79	3,615	1,493	5,616
11 Évora	6.00	2	8	2	3	19	12	512	276	332	95	7,230	735	5,494	349	4,546	4,366	10,276
12 Faro	11.00	8	4	2	4	18	12	571	486	482	85	2,936	1,362	9,124	702	4,305	1,665	13,339
13 Figueira da Foz	3.33	1	5	0	2	8	2	352	86	127	78	997	274	3,230	52	2,579	343	3,083
14 Guarda	7.00	2	5	2	3	9	5	578	144	210	83	4,932	487	4,876	207	2,760	960	5,069
15 Guimarães	14.00	5	5	3	7	16	10	1,575	462	244	104	868	1,122	11,229	154	7,308	1,097	10,514
16 Lamego	3.33	1	2	1	2	6	2	296	125	47	9	2,125	136	761	24	1,224	502	1,905
17 Leiria	12.00	7	5	2	4	40	4	738	301	380	170	2,448	1,376	17,802	1,024	8,536	2,714	14,523
18 Lisboa	42.00	12	16	3	10	23	31	621	831	1,280	514	151	5,495	40,796	2,688	18,146	1,086	47,381
19 Penafiel	10.00	3	4	0	3	16	6	524	368	67	66	1,330	777	8,006	1	4,565	8	5,142
20 Portalegre	3.00	3	7	1	2	7	3	273	75	103	28	6,250	290	1,472	55	1,664	1,340	4,407
21 Portimão	7.00	1	2	1	3	13	2	395	196	239	51	2,060	925	5,691	52	1,745	1,122	5,219
22 Porto	39.00	14	15	2	11	66	22	1,592	1,218	1,083	907	1,022	4,918	66,932	1,495	27,133	815	38,479
23 Santarém	11.67	2	8	1	4	47	5	815	499	504	107	5,026	1,689	11,207	262	5,200	1,613	8,812
24 São João da Madeira	11.00	2	3	1	4	58	8	963	575	515	239	976	1,214	6,352	0	5,824	424	6,829
25 Setúbal	13.00	8	7	0	4	20	20	870	325	942	163	823	1,719	20,248	63	5,403	106	12,793
26 Sintra	19.00	4	2	0	5	14	13	14	712	777	228	462	3,770	10,698	8	6,131	333	7,019
27 Tomar	4.33	2	6	0	2	12	2	368	124	238	32	1,292	620	3,417	41	3,521	723	5,586
28 Torres Vedras	7.67	2	4	1	3	8	7	429	317	491	263	1,073	1,088	5,562	23	5,858	413	8,211
29 Viana do Castelo	9.00	4	5	0	3	27	27	616	468	307	192	2,218	1,291	5,513	136	4,887	1,070	7,287
30 Vila Franca de Xira	12.00	1	6	0	4	41	6	736	760	285	163	1,130	1,935	15,331	427	3,635	3,443	8,243
31 Vila Real	5.67	2	7	0	2	1	2	741	139	47	59	4,307	309	2,280	4	1,550	488	2,514
32 Viseu	9.00	7	6	3	5	6	15	521	154	915	240	3,489	830	15,077	240	23,307	999	31,206

Sources: Own elaboration, based on data from the ACT and the Portugal Statistics Online Database (PORDATA, 2013)

Appendix 9 - ACT local branches input and output data for the DEA Cost Efficiency Model 2

ACT LOCAL BRANCHES	COSTS (€)	WRAINQ	SUSPNOT	FINCOL	INFRNOT	IMPRNOT	OTHNOT	AREA	INSPVIS	WRKCOVINS	WRINFSRV	PRINFSRV	PHINFSRV	COVINFAW
	{I}	{O}	{O}	{O}	{O}	{O}	{O}	{ON}	{O}	{O}	{O}	{O}	{O}	{O}
1 Almada	688,828.77	11	9	500	316	447	158	360	1,339	5,147	294	5,623	2,302	9,332
2 Aveiro	905,938.09	18	15	1,577	136	510	51	1,804	1,592	14,320	1,217	20,989	4,726	29,402
3 Barreiro	378,692.89	5	6	733	265	539	140	440	798	8,932	287	6,737	300	7,946
4 Beja	642,631.17	17	8	772	264	85	42	13,851	430	3,070	416	1,911	2,423	5,508
5 Braga	1,048,743.37	14	10	896	248	328	78	1,838	1,454	10,889	441	14,432	2,183	18,127
6 Bragança	334,010.38	16	9	328	126	160	115	6,600	585	1,856	64	1,253	447	5,687
7 Caldas da Rainha	323,741.23	11	6	914	50	515	152	1,057	579	3,934	20	3,328	49	5,931
8 Castelo Branco	332,337.32	11	6	359	203	354	412	5,089	716	2,966	80	2,194	739	4,168
9 Coimbra	1,195,675.00	11	26	585	342	400	155	2,976	1,087	10,706	856	8,511	4,325	22,758
10 Covilhã	193,149.78	11	4	276	112	185	79	1,939	602	7,164	79	3,615	1,493	5,616
11 Évora	442,140.25	19	12	512	276	332	95	7,230	735	5,494	349	4,546	4,366	10,276
12 Faro	745,010.03	18	12	571	486	482	85	2,936	1,362	9,124	702	4,305	1,665	13,339
13 Figueira da Foz	234,179.17	8	2	352	86	127	78	997	274	3,230	52	2,579	343	3,083
14 Guarda	510,131.46	9	5	578	144	210	83	4,932	487	4,876	207	2,760	960	5,069
15 Guimarães	768,908.74	16	10	1,575	462	244	104	868	1,122	11,229	154	7,308	1,097	10,514
16 Lamego	167,365.61	6	2	296	125	47	9	2,125	136	761	24	1,224	502	1,905
17 Leiria	750,439.98	40	4	738	301	380	170	2,448	1,376	17,802	1,024	8,536	2,714	14,523
18 Lisboa	2,523,890.03	23	31	621	831	1,280	514	151	5,495	40,796	2,688	18,146	1,086	47,381
19 Penafiel	469,296.43	16	6	524	368	67	66	1,330	777	8,006	1	4,565	8	5,142
20 Portalegre	301,937.45	7	3	273	75	103	28	6,250	290	1,472	55	1,664	1,340	4,407
21 Portimão	307,392.96	13	2	395	196	239	51	2,060	925	5,691	52	1,745	1,122	5,219
22 Porto	2,238,767.00	66	22	1,592	1,218	1,083	907	1,022	4,918	66,932	1,495	27,133	815	38,479
23 Santarém	604,032.44	47	5	815	499	504	107	5,026	1,689	11,207	262	5,200	1,613	8,812
24 São João da Madeira	429,712.24	58	8	963	575	515	239	976	1,214	6,352	0	5,824	424	6,829
25 Setúbal	768,953.66	20	20	870	325	942	163	823	1,719	20,248	63	5,403	106	12,793
26 Sintra	797,342.95	14	13	14	712	777	228	462	3,770	10,698	8	6,131	333	7,019
27 Tomar	342,754.52	12	2	368	124	238	32	1,292	620	3,417	41	3,521	723	5,586
28 Torres Vedras	413,567.17	8	7	429	317	491	263	1,073	1,088	5,562	23	5,858	413	8,211
29 Viana do Castelo	497,268.91	27	27	616	468	307	192	2,218	1,291	5,513	136	4,887	1,070	7,287
30 Vila Franca de Xira	501,641.06	41	6	736	760	285	163	1,130	1,935	15,331	427	3,635	3,443	8,243
31 Vila Real	375,248.20	1	2	741	139	47	59	4,307	309	2,280	4	1,550	488	2,514
32 Viseu	676,749.13	6	15	521	154	915	240	3,489	830	15,077	240	23,307	999	31,206

Sources: Own elaboration, based on data from the ACT and the PORDATA (2013).

Appendix 10 - ACT local branches input and outcome data for the DEA Effectiveness Model 3

ACT LOCAL BRANCHES	UNINPUT {I}	PFWRA {O}	PNFWRA {O}	PDAYSAbs {O}
1 Almada	1	127.30	49,963.60	1,769,527.55
2 Aveiro	1	80.64	17,780.69	2,317,993.60
3 Barreiro	1	170.85	54,391.39	1,439,329.46
4 Beja	1	128.75	52,826.07	1,723,457.58
5 Braga	1	177.31	27,174.53	2,476,520.27
6 Bragança	1	100.77	38,481.27	1.00
7 Caldas da Rainha	1	40.94	16,504.18	2,547,925.94
8 Castelo Branco	1	162.32	56,982.20	2,149,578.47
9 Coimbra	1	112.31	39,657.07	2,532,019.29
10 Covilhã	1	198.74	49,131.79	2,094,255.53
11 Évora	1	190.89	50,934.26	925,889.36
12 Faro	1	186.37	35,343.47	1,967,502.97
13 Figueira da Foz	1	28.67	45,722.48	2,209,189.14
14 Guarda	1	76.05	53,891.73	2,191,467.20
15 Guimarães	1	203.56	14,895.10	2,158,603.93
16 Lamego	1	138.64	43,521.64	2,424,968.83
17 Leiria	1	135.13	1.00	3,179,677.85
18 Lisboa	1	192.75	30,935.40	1,509,585.49
19 Penafiel	1	73.46	26,093.08	1,841,015.47
20 Portalegre	1	48.66	44,296.36	1,043,157.81
21 Portimão	1	101.98	49,200.15	1,837,595.37
22 Porto	1	189.09	27,678.20	2,222,024.61
23 Santarém	1	1.00	39,874.59	1,998,644.03
24 São João da Madeira	1	206.44	22,720.11	2,313,500.22
25 Setúbal	1	140.30	26,191.06	703,889.91
26 Sintra	1	197.25	57,030.73	1,798,315.82
27 Tomar	1	170.85	18,600.38	2,583,419.67
28 Torres Vedras	1	215.94	47,562.61	1,606,222.36
29 Viana do Castelo	1	166.66	31,799.84	2,028,282.11
30 Vila Franca de Xira	1	136.12	28,923.91	1,206,818.82
31 Vila Real	1	185.59	40,318.76	1,969,899.91
32 Viseu	1	162.97	40,957.06	2,293,498.78

Sources: Own elaboration, based on data from the ACT, GEP (2015), INE (2013) and Eurostat (2016).

Appendix 11 - Additional data on the ACT local branches activities and environment

Appendix 11.1 - Employed population per ACT local branch jurisdiction area and economic activity sector

ACT LOCAL BRANCHES	EMPOP_A	EMPOP_B	EMPOP_C	EMPOP_D	EMPOP_E	EMPOP_F	EMPOP_G	EMPOP_H	EMPOP_I	EMPOP_J	EMPOP_K
1 Almada	1,288	279	13,702	1,149	1,085	11,259	27,028	7,241	12,412	6,684	6,552
2 Aveiro	4,398	213	49,630	826	939	11,988	30,742	4,555	8,815	2,531	2,381
3 Barreiro	1,391	44	10,545	494	594	4,721	14,050	4,183	5,200	2,825	2,459
4 Beja	10,501	1,803	8,383	969	681	7,055	13,120	2,259	6,312	936	1,262
5 Braga	5,139	492	48,024	1,091	1,136	26,083	32,568	3,915	10,076	2,613	2,524
6 Bragança	5,600	196	3,326	306	344	4,653	7,119	956	2,829	378	762
7 Caldas da Rainha	4,656	434	12,510	352	508	6,142	14,101	2,245	5,004	918	1,171
8 Castelo Branco	1,865	35	6,054	211	300	4,032	6,183	1,204	2,494	624	623
9 Coimbra	2,663	333	16,218	869	832	11,107	21,167	4,773	7,035	2,368	1,978
10 Covilhã	1,453	326	6,232	151	256	2,979	5,815	883	2,146	447	528
11 Évora	6,451	683	8,526	324	328	4,580	10,479	1,713	4,295	767	1,377
12 Faro	4,099	334	5,845	730	891	11,349	22,512	3,787	19,347	1,541	2,053
13 Figueira da Foz	2,136	96	8,221	586	355	4,286	7,690	2,533	2,687	605	683
14 Guarda	3,318	270	6,311	402	293	5,449	8,234	2,189	3,199	417	810
15 Guimarães	1,935	329	68,414	603	830	14,082	26,209	2,965	7,131	1,361	1,719
16 Lamego	5,676	180	2,667	229	202	6,503	5,380	977	2,447	196	500
17 Leiria	2,643	923	31,017	676	880	13,366	23,494	4,236	6,642	1,469	2,181
18 Lisboa	883	130	22,459	2,231	1,358	19,890	54,579	16,546	27,764	22,263	19,519
19 Penafiel	2,985	1,454	61,796	1,094	891	30,245	30,053	4,129	7,196	1,371	1,841
20 Portalegre	3,809	147	4,208	252	412	2,864	6,439	1,164	2,959	301	647
21 Portimão	2,043	108	2,932	370	596	6,837	12,618	1,584	11,663	715	1,029
22 Porto	7,520	459	104,950	3,531	4,071	36,859	112,788	23,257	35,983	13,492	14,437
23 Santarém	7,601	651	18,736	960	1,007	8,441	22,186	5,356	6,049	1,747	2,106
24 São João da Madeira	1,805	224	50,592	462	593	10,534	21,423	2,699	4,770	1,109	1,593
25 Setúbal	2,139	74	13,450	696	774	5,284	14,129	3,853	5,210	2,634	2,040
26 Sintra	1,341	235	30,491	1,704	2,560	20,021	57,822	13,887	25,228	16,623	15,412
27 Tomar	1,334	145	9,612	405	522	6,350	11,729	3,032	4,074	705	1,016
28 Torres Vedras	5,020	143	12,671	497	783	8,615	19,374	3,915	4,988	2,099	2,394
29 Viana do Castelo	3,582	518	17,016	597	551	13,229	15,190	2,239	5,542	750	1,304
30 Vila Franca de Xira	1,950	287	23,137	1,280	1,761	11,980	36,253	15,261	12,307	6,696	5,874
31 Vila Real	8,781	618	5,314	449	575	7,536	11,122	1,776	4,682	571	1,106
32 Viseu	5,050	468	17,475	592	654	11,293	18,106	3,696	5,864	1,552	1,591

Notes: (1) 'EMPOP_X' stands for 'Employed population in the economic activity sector X'; (2) - Economic activity sectors: A - Agriculture, forestry and fishing; B - Mining and quarrying; C - Manufacturing; D - Electricity, gas, steam and air conditioning supply; E - Water supply; sewerage, waste management and remediation activities; F - Construction; G - Wholesale and retail trade; repair of motor vehicles and motorcycles; H - Transportation and storage; I - Accommodation and food service activities; J - Information and communication; and K - Financial and insurance activities.

Source: Own elaboration, based on data from INE (2013).

Appendix 11.1 - Employed population per ACT local branch jurisdiction area and economic activity sector (Cont.)

ACT LOCAL BRANCHES	EMPOP_L	EMPOP_M	EMPOP_N	EMPOP_O	EMPOP_P	EMPOP_Q	EMPOP_R	EMPOP_S	EMPOP_T	EMPOP_U	TOTEMPOP
1 Almada	1,344	8,080	9,956	16,949	13,446	13,842	2,051	4,233	2,896	83	161,559
2 Aveiro	629	5,108	4,989	8,126	15,054	11,694	1,097	2,703	2,410	6	168,834
3 Barreiro	494	2,960	4,992	7,818	6,020	6,934	743	1,863	1,211	16	79,557
4 Beja	299	2,012	3,090	10,334	7,476	7,875	623	1,360	1,149	5	87,504
5 Braga	954	6,238	5,558	9,770	17,853	12,802	1,298	3,692	3,672	4	195,502
6 Bragança	106	1,137	1,120	5,192	5,507	5,544	236	907	739	1	46,958
7 Caldas da Rainha	392	2,360	2,448	4,436	5,642	5,071	603	1,321	909	3	71,226
8 Castelo Branco	136	1,103	1,397	3,976	3,858	4,230	229	753	599	0	39,906
9 Coimbra	556	5,210	4,588	9,886	14,621	18,929	1,060	2,415	2,603	16	129,227
10 Covilhã	101	1,043	994	2,374	3,830	3,534	200	672	356	0	34,320
11 Évora	192	1,905	2,254	8,037	6,727	6,541	496	1,104	1,211	6	67,996
12 Faro	1,667	4,492	7,666	9,461	9,899	8,314	2,258	2,561	1,314	13	120,133
13 Figueira da Foz	176	1,322	1,612	3,785	3,938	4,699	379	822	627	0	47,238
14 Guarda	93	1,284	1,330	5,263	5,503	6,317	316	931	630	1	52,560
15 Guimarães	522	4,430	3,456	5,472	11,625	9,115	933	3,144	1,337	4	165,616
16 Lamego	59	723	972	3,458	3,625	2,650	188	629	1,042	0	38,303
17 Leiria	470	4,405	3,444	6,452	9,301	8,525	902	2,257	1,374	7	124,664
18 Lisboa	3,960	31,230	25,710	29,754	31,729	34,067	6,137	9,362	9,956	343	369,870
19 Penafiel	513	4,094	3,954	8,595	11,548	8,139	811	2,592	3,678	3	186,982
20 Portalegre	93	1,104	1,222	5,860	3,910	5,240	287	775	861	0	42,554
21 Portimão	977	2,186	3,626	5,369	5,070	4,862	1,335	1,390	745	3	66,058
22 Porto	4,132	28,346	26,889	28,695	52,700	49,874	6,271	12,946	11,360	76	578,636
23 Santarém	429	3,576	4,139	9,632	8,678	8,931	869	2,076	1,752	10	114,932
24 São João da Madeira	365	3,134	2,719	4,425	8,650	6,848	683	2,030	1,458	3	126,119
25 Setúbal	600	3,401	4,215	7,476	7,421	6,874	947	1,736	1,147	19	84,119
26 Sintra	3,400	21,695	22,278	25,734	27,031	27,213	5,368	8,650	9,874	286	336,853
27 Tomar	244	2,065	1,813	5,536	6,032	5,762	472	1,464	899	3	63,214
28 Torres Vedras	550	3,838	3,351	5,926	6,561	6,525	827	1,762	1,617	7	91,463
29 Viana do Castelo	372	2,600	2,589	6,296	8,174	7,002	643	1,732	1,865	3	91,794
30 Vila Franca de Xira	1,284	8,275	12,667	14,384	12,917	13,389	1,609	4,518	3,939	59	189,827
31 Vila Real	148	1,861	1,839	6,760	8,538	7,043	500	1,346	1,407	1	71,973
32 Viseu	291	2,955	2,874	7,642	11,170	9,254	579	1,789	1,857	3	104,755

Notes: (1) - Economic sectors: L - Real estate activities; M - Professional, scientific and technical activities; N - Administrative and support service activities; O- Public administration and defence; compulsory social security; P - Education; Q - Human health and social work activities; R - Arts, entertainment and recreation; S - Other service activities; T - Activities of households as employers; undifferentiated goods and services producing activities of households for own use; U - Activities of extraterritorial organisations and bodies; (2) 'TOTEMPOP' stands for 'Total employed population'.

Source: Own elaboration, based on data from INE (2013).

Appendix 11.2 - Fatal work-related accidents per ACT local branch jurisdiction area and economic activity sector

ACT LOCAL BRANCHES	FWRA_A	FWRA_B	FWRA_C	FWRA_D	FWRA_E	FWRA_F	FWRA_G	FWRA_H	FWRA_I	FWRA_J	FWRA_K
1 Almada	1	0	1	0	0	0	1	0	0	0	0
2 Aveiro	1	0	4	0	0	2	0	4	0	0	0
3 Barreiro	0	0	0	0	0	1	0	1	0	0	0
4 Beja	2	0	1	0	0	1	0	0	0	0	0
5 Braga	1	0	0	0	0	5	0	0	0	0	0
6 Bragança	1	0	0	0	0	1	0	0	0	0	0
7 Caldas da Rainha	4	0	0	0	0	0	0	2	0	0	0
8 Castelo Branco	1	0	0	0	0	0	0	0	0	0	0
9 Coimbra	1	0	1	0	0	2	0	2	0	0	0
10 Covilhã	0	0	0	0	0	0	1	0	0	0	0
11 Évora	1	0	0	0	0	0	1	0	0	0	0
12 Faro	1	0	0	0	0	0	0	0	1	0	0
13 Figueira da Foz	4	0	0	0	0	0	0	0	0	0	0
14 Guarda	0	0	1	0	0	2	1	0	0	0	0
15 Guimarães	0	0	1	0	0	1	1	0	0	0	0
16 Lamego	1	0	0	0	0	2	0	0	0	0	0
17 Leiria	1	0	2	0	0	1	0	0	0	0	0
18 Lisboa	0	0	1	0	0	1	2	0	0	0	0
19 Penafiel	0	2	1	0	0	1	0	0	0	0	0
20 Portalegre	1	0	0	0	0	1	1	0	0	0	0
21 Portimão	0	0	2	0	0	0	0	0	0	0	0
22 Porto	1	0	3	0	0	0	0	0	0	0	0
23 Santarém	1	1	0	0	0	0	0	0	0	0	0
24 São João da Madeira	0	0	0	0	0	1	0	0	0	0	0
25 Setúbal	0	0	0	0	0	0	0	2	0	0	0
26 Sintra	0	0	0	0	0	1	0	1	0	0	1
27 Tomar	0	0	2	0	0	1	1	0	0	0	0
28 Torres Vedras	0	0	0	0	0	0	0	0	0	0	0
29 Viana do Castelo	0	0	1	0	0	4	2	0	0	0	0
30 Vila Franca de Xira	1	0	1	0	0	1	1	2	0	0	0
31 Vila Real	0	0	0	0	0	0	1	0	1	0	0
32 Viseu	0	0	0	0	0	1	0	1	1	0	0

Notes: (1) 'FWRA_X' stands for 'Numbner of fatal work-related accidents in sector X'; (2) - Economic activity sectors: A - Agriculture, forestry and fishing; B - Mining and quarrying; C - Manufacturing; D - Electricity, gas, steam and air conditioning supply; E - Water supply; sewerage, waste management and remediation activities; F - Construction; G - Wholesale and retail trade; repair of motor vehicles and motorcycles; H - Transportation and storage; I - Accommodation and food service activities; J - Information and communication; and K - Financial and insurance activities.

Source: Own elaboration, based on data from the ACT and the GEP (of the MTSSS).

Appendix 11.2 - Fatal work-related accidents per ACT local branch jurisdiction area and economic activity sector (Cont.)

ACT LOCAL BRANCHES	FWRA_L	FWRA_M	FWRA_N	FWRA_O	FWRA_P	FWRA_Q	FWRA_R	FWRA_S	FWRA_T	FWRA_U	TFWRA
1 Almada	0	0	0	0	0	0	0	0	0	0	3
2 Aveiro	0	0	0	0	0	0	0	0	0	0	11
3 Barreiro	0	0	0	0	0	0	0	0	0	0	2
4 Beja	0	0	1	1	0	0	0	0	0	0	6
5 Braga	0	0	0	0	0	0	0	0	0	0	6
6 Bragança	0	0	0	3	0	1	0	0	0	0	6
7 Caldas da Rainha	0	0	0	0	0	0	0	0	0	0	6
8 Castelo Branco	0	0	0	0	0	0	0	0	0	0	1
9 Coimbra	0	0	0	0	0	0	0	0	0	0	6
10 Covilhã	0	0	0	0	0	0	0	0	0	0	1
11 Évora	0	0	0	0	0	0	0	0	0	0	2
12 Faro	0	0	0	0	0	0	0	0	0	0	2
13 Figueira da Foz	0	0	0	0	0	0	0	0	0	0	4
14 Guarda	0	0	1	0	0	0	0	0	0	0	5
15 Guimarães	0	0	0	0	0	0	0	0	0	0	3
16 Lamego	0	0	0	1	0	0	0	0	0	0	4
17 Leiria	0	0	1	0	0	0	0	0	0	0	5
18 Lisboa	0	0	0	0	0	0	0	0	1	0	5
19 Penafiel	0	0	0	0	0	0	0	0	0	0	4
20 Portalegre	0	1	0	0	0	0	0	0	0	0	4
21 Portimão	0	1	0	0	0	0	0	0	0	0	3
22 Porto	0	0	1	2	0	0	0	0	0	0	7
23 Santarém	0	0	0	0	0	0	0	1	0	0	3
24 São João da Madeira	0	0	0	0	0	0	0	0	0	0	1
25 Setúbal	0	0	1	0	0	0	0	0	0	0	3
26 Sintra	0	0	0	0	0	0	0	0	0	0	3
27 Tomar	0	0	0	0	0	0	0	0	0	0	4
28 Torres Vedras	0	0	0	0	0	0	0	0	0	0	0
29 Viana do Castelo	0	0	0	0	0	0	0	0	0	0	7
30 Vila Franca de Xira	0	0	0	0	0	0	0	0	0	0	6
31 Vila Real	0	0	0	0	0	0	0	0	0	0	2
32 Viseu	0	0	0	0	0	0	0	0	0	0	3

Notes: (1) - Sectors: L - Real estate activities; M - Professional, scientific and technical activities; N - Administrative and support service activities; O- Public administration and defence; compulsory social security; P - Education; Q - Human health and social work activities; R - Arts, entertainment and recreation; S - Other service activities; T - Activities of households as employers; undifferentiated goods and services producing activities of households for own use; U - Activities of extraterritorial organisations and bodies; (2) 'TFWRA' stands for 'Total fatal work-related accidents'.

Source: Own elaboration, based on data from the ACT and GEP.

Appendix 11.3 - Non-fatal work-related accidents per ACT local branch jurisdiction area and economic activity sector

ACT LOCAL BRANCHES	NFWRA_A	NFWRA_B	NFWRA_C	NFWRA_D	NFWRA_E	NFWRA_F	NFWRA_G	NFWRA_H	NFWRA_I	NFWRA_J	NFWRA_K
1 Almada	237	0	263	0	13	170	564	184	174	21	0
2 Aveiro	198	19	3,354	0	77	729	1,084	341	225	6	0
3 Barreiro	103	0	285	0	46	80	322	66	86	0	0
4 Beja	267	30	185	0	25	291	185	69	86	10	0
5 Braga	161	43	1,913	0	79	1,370	1,018	149	255	18	22
6 Bragança	88	11	132	0	16	313	148	32	44	6	0
7 Caldas da Rainha	289	72	648	0	29	329	602	82	115	9	0
8 Castelo Branco	45	0	94	0	18	169	127	38	45	6	0
9 Coimbra	138	7	812	0	64	637	580	229	137	13	0
10 Covilhã	25	29	192	0	6	90	108	28	45	0	0
11 Évora	198	84	254	0	5	120	166	26	73	6	0
12 Faro	137	11	188	0	112	264	606	205	483	1	0
13 Figueira da Foz	99	5	317	0	13	152	143	92	31	4	0
14 Guarda	46	9	124	0	22	268	112	56	51	0	0
15 Guimarães	86	21	2,893	5	112	835	1,023	166	171	0	0
16 Lamego	124	22	115	0	4	311	174	25	54	0	5
17 Leiria	193	88	2,267	0	98	1,015	1,044	329	209	21	0
18 Lisboa	12	0	705	0	92	795	2,568	1,662	1,303	111	55
19 Penafiel	180	98	3,117	10	26	1,483	1,148	295	247	5	5
20 Portalegre	143	11	171	6	17	77	131	16	43	6	6
21 Portimão	38	4	79	0	10	154	287	20	222	5	4
22 Porto	269	6	4,764	6	408	2,171	3,482	1,188	1,283	47	80
23 Santarém	365	27	902	0	62	427	581	193	54	10	10
24 São João da Madeira	123	0	2,935	5	17	659	604	125	169	6	18
25 Setúbal	82	7	687	0	58	190	342	122	120	21	0
26 Sintra	31	0	657	0	168	596	1,309	323	416	79	11
27 Tomar	96	23	428	0	17	305	350	95	87	7	0
28 Torres Vedras	281	0	589	0	20	190	547	210	74	0	5
29 Viana do Castelo	77	35	761	10	20	579	437	104	85	0	0
30 Vila Franca de Xira	98	17	806	0	327	352	870	636	192	21	0
31 Vila Real	126	64	311	6	5	429	298	46	93	21	5
32 Viseu	180	6	846	0	26	617	470	117	103	8	7

Notes: (1) 'NFWRA_X' stands for 'Number of non-fatal work-related accidents in sector X'; (2) - Economic activity sectors: A - Agriculture, forestry and fishing; B - Mining and quarrying; C - Manufacturing; D - Electricity, gas, steam and air conditioning supply; E - Water supply; sewerage, waste management and remediation activities; F - Construction; G - Wholesale and retail trade; repair of motor vehicles and motorcycles; H - Transportation and storage; I - Accommodation and food service activities; J - Information and communication; and K - Financial and insurance activities.

Source: Own elaboration, based on data from the ACT and GEP.

Appendix 11.3 - Non-fatal work-related accidents per ACT local branch jurisdiction area and economic activity sector (Cont.)

ACT LOCAL BRANCHES	NFWRA_L	NFWRA_M	NFWRA_N	NFWRA_O	NFWRA_P	NFWRA_Q	NFWRA_R	NFWRA_S	NFWRA_T	NFWRA_U	TNFWRA
1 Almada	9	26	115	202	36	111	34	19	6	0	2,185
2 Aveiro	4	19	516	238	28	269	16	22	19	0	7,165
3 Barreiro	0	19	131	71	11	98	4	6	0	0	1,327
4 Beja	0	12	214	144	4	155	6	5	0	0	1,687
5 Braga	16	33	194	107	46	208	93	83	63	0	5,873
6 Bragança	11	0	23	56	5	67	0	7	6	0	965
7 Caldas da Rainha	0	20	174	61	25	127	22	12	23	0	2,638
8 Castelo Branco	0	0	38	10	14	61	0	18	0	0	682
9 Coimbra	5	19	95	132	5	349	6	86	0	0	3,313
10 Covilhã	0	0	28	16	0	33	7	17	0	0	626
11 Évora	0	6	40	112	6	122	6	4	0	0	1,229
12 Faro	54	24	181	125	20	216	70	42	4	0	2,742
13 Figueira da Foz	0	27	96	15	6	96	0	5	6	0	1,107
14 Guarda	0	5	21	50	9	82	4	16	0	0	876
15 Guimarães	17	19	327	83	26	178	21	124	14	0	6,121
16 Lamego	0	11	12	21	0	34	0	6	22	0	941
17 Leiria	22	51	357	80	25	221	24	49	17	0	6,112
18 Lisboa	57	244	1,705	264	150	1,124	102	214	81	5	11,249
19 Penafiel	14	45	167	90	43	173	20	82	44	0	7,293
20 Portalegre	0	9	59	71	0	65	0	12	0	0	841
21 Portimão	30	19	100	179	0	117	53	20	6	0	1,346
22 Porto	109	260	1,874	527	139	1,153	179	181	128	0	18,253
23 Santarém	0	26	142	54	14	263	25	43	5	0	3,202
24 São João da Madeira	17	49	378	47	21	176	5	28	25	0	5,408
25 Setúbal	1	11	504	262	9	149	21	26	0	0	2,611
26 Sintra	16	85	606	189	105	375	58	46	51	0	5,123
27 Tomar	0	6	107	92	5	127	12	112	18	0	1,888
28 Torres Vedras	5	10	121	188	6	163	4	31	12	0	2,455
29 Viana do Castelo	18	11	222	85	22	111	11	41	20	0	2,646
30 Vila Franca de Xira	5	154	627	214	39	211	14	57	0	0	4,639
31 Vila Real	0	27	16	49	6	96	11	24	6	0	1,638
32 Viseu	0	38	175	29	6	214	28	25	22	0	2,918

Notes: (1) - Sectors: L - Real estate activities; M - Professional, scientific and technical activities; N - Administrative and support service activities; O- Public administration and defence; compulsory social security; P - Education; Q - Human health and social work activities; R - Arts, entertainment and recreation; S - Other service activities; T - Activities of households as employers; undifferentiated goods and services producing activities of households for own use; U - Activities of extraterritorial organisations and bodies; (2) 'TNFWRA' stands for 'Total non-fatal work-related accidents'.

Source: Own elaboration, based on data from the ACT and GEP.

Appendix 11.4 - Days of absence from work per ACT local branch jurisdiction area and economic activity sector

ACT LOCAL BRANCHES	DAYSABS_A	DAYSABS_B	DAYSABS_C	DAYSABS_D	DAYSABS_E	DAYSABS_F	DAYSABS_G	DAYSABS_H	DAYSABS_I	DAYSABS_J	DAYSABS_K
1 Almada	12,276	0	11,674	0	685	12,107	17,871	11,067	9,388	339	0
2 Aveiro	9,522	379	108,862	0	2,882	30,614	33,058	12,409	11,527	1,346	0
3 Barreiro	6,252	0	14,766	0	4,209	3,921	8,662	2,243	1,915	0	0
4 Beja	16,473	1,292	7,228	0	832	15,838	4,236	4,943	6,088	230	0
5 Braga	5,633	1,172	64,751	0	1,517	56,144	33,229	8,204	9,642	992	1,071
6 Bragança	4,643	1,175	6,548	0	592	17,170	8,743	587	1,707	594	0
7 Caldas da Rainha	9,231	2,160	16,948	0	2,190	20,264	15,702	5,359	4,787	598	0
8 Castelo Branco	1,088	0	3,150	0	368	8,637	5,931	1,416	785	667	0
9 Coimbra	5,511	77	25,869	0	1,111	23,325	18,176	8,024	3,722	476	0
10 Covilhã	1,334	1,423	6,321	0	56	6,112	3,154	1,445	1,613	0	0
11 Évora	7,694	10,055	12,940	0	1,015	6,001	4,455	2,113	2,325	56	0
12 Faro	5,242	138	8,785	0	4,131	11,259	16,515	15,286	16,778	6	0
13 Figueira da Foz	5,816	147	6,632	0	255	7,886	4,759	4,084	565	598	0
14 Guarda	1,623	369	3,995	0	333	10,314	5,806	2,497	1,347	0	0
15 Guimarães	3,440	2,265	94,322	23	2,700	41,919	37,725	7,046	6,056	0	0
16 Lamego	6,830	537	3,278	0	120	11,351	6,137	749	2,255	0	77
17 Leiria	6,214	5,773	63,614	0	2,251	33,348	28,433	12,135	4,068	1,879	0
18 Lisboa	301	0	29,872	0	4,497	49,376	76,722	71,031	50,293	5,397	1,670
19 Penafiel	12,403	4,588	114,398	2,151	661	54,686	42,710	14,700	7,623	38	95
20 Portalegre	6,721	228	9,872	952	1,692	6,806	4,572	1,711	3,890	771	946
21 Portimão	2,715	53	2,260	0	117	6,460	11,734	415	8,658	38	71
22 Porto	9,330	95	170,507	34	15,166	88,970	112,127	52,683	43,193	1,269	2,460
23 Santarém	15,092	586	33,083	0	4,065	22,081	31,184	8,523	1,154	276	480
24 São João da Madeira	5,908	0	97,371	98	316	22,550	20,325	7,645	6,817	513	1,804
25 Setúbal	5,035	1,176	32,758	0	1,322	9,634	12,205	5,618	6,736	539	0
26 Sintra	433	0	31,462	0	5,366	38,710	47,844	16,600	21,637	3,682	850
27 Tomar	2,204	836	17,731	0	439	10,658	13,773	3,312	3,355	990	0
28 Torres Vedras	14,487	0	20,136	0	355	7,761	23,204	10,912	2,630	0	108
29 Viana do Castelo	3,137	890	32,102	84	620	29,750	15,614	5,106	7,686	0	0
30 Vila Franca de Xira	9,230	1,972	40,586	0	13,477	14,491	33,252	32,934	8,988	1,247	0
31 Vila Real	7,556	2,622	10,027	397	1,735	27,797	9,876	1,335	3,994	332	257
32 Viseu	6,235	39	29,094	0	888	26,462	20,327	3,857	3,017	48	273

Notes: (1) 'DAYSABS_X' stands for 'Number of days of absence from work in sector X'; (2) - Economic activity sectors: A - Agriculture, forestry and fishing; B - Mining and quarrying; C - Manufacturing; D - Electricity, gas, steam and air conditioning supply; E - Water supply; sewerage, waste management and remediation activities; F - Construction; G - Wholesale and retail trade; repair of motor vehicles and motorcycles; H - Transportation and storage; I - Accommodation and food service activities; J - Information and communication; and K - Financial and insurance activities.

Source: Own elaboration, based on data from the ACT and GEP.

Appendix 11.4 - Days of absence from work per ACT local branch jurisdiction area and economic activity sector (Cont.)

ACT LOCAL BRANCHES	DAYSABS_L	DAYSABS_M	DAYSABS_N	DAYSABS_O	DAYSABS_P	DAYSABS_Q	DAYSABS_R	DAYSABS_S	DAYSABS_T	DAYSABS_U	T DAYSABS
1 Almada	226	320	4,785	9,355	7,246	5,844	572	419	908	0	105,082
2 Aveiro	1,232	981	17,840	12,230	858	9,215	150	448	2,432	0	255,983
3 Barreiro	0	132	5,775	2,714	1,138	5,490	159	67	0	0	57,443
4 Beja	0	181	8,515	5,895	208	5,170	882	409	0	0	78,421
5 Braga	303	2,876	8,447	4,154	2,162	10,388	3,596	1,954	3,388	0	219,622
6 Bragança	2,073	0	523	3,169	156	1,544	0	1,461	451	0	51,136
7 Caldas da Rainha	0	413	6,606	1,228	481	4,298	245	354	847	0	91,712
8 Castelo Branco	0	0	1,200	672	253	1,420	0	217	0	0	25,805
9 Coimbra	219	537	3,484	6,368	23	8,510	187	2,159	0	0	107,777
10 Covilhã	0	0	529	455	0	1,396	209	899	0	0	24,945
11 Évora	0	197	2,092	3,988	84	6,200	78	95	0	0	59,387
12 Faro	1,913	823	6,715	3,903	1,839	6,138	4,304	2,499	682	0	106,955
13 Figueira da Foz	0	544	4,408	539	62	3,067	0	182	121	0	39,667
14 Guarda	0	151	2,785	1,499	66	1,779	112	119	0	0	32,795
15 Guimarães	647	361	9,120	5,310	593	6,229	564	3,073	1,316	0	222,710
16 Lagoa	0	281	288	988	0	1,582	0	202	2,905	0	37,581
17 Leiria	249	978	6,266	2,740	1,149	5,360	409	650	679	0	176,194
18 Lisboa	3,611	9,133	66,389	18,674	10,704	49,208	7,552	7,825	5,104	1,177	468,538
19 Penafiel	924	1,625	6,988	3,781	1,055	6,763	471	3,264	3,783	0	282,707
20 Portalegre	0	526	2,391	3,064	0	6,581	0	278	0	0	51,002
21 Portimão	2,086	3,637	5,509	4,790	0	5,119	2,610	1,077	814	0	58,164
22 Porto	3,021	9,806	62,295	32,541	4,328	46,187	7,352	5,580	11,125	0	678,070
23 Santarém	0	1,379	5,417	2,977	306	12,226	506	1,029	418	0	140,782
24 São João da Madeira	280	4,707	10,544	2,544	902	6,840	48	1,336	758	0	191,305
25 Setúbal	126	2,597	18,556	9,493	74	7,492	2,721	600	0	0	116,680
26 Sintra	2,282	3,113	35,817	11,973	4,853	16,185	2,866	2,369	1,366	0	247,409
27 Tomar	0	1,303	2,207	3,339	27	6,315	429	3,651	1,988	0	72,556
28 Torres Vedras	278	192	9,129	10,332	282	8,912	1,140	1,621	664	0	112,143
29 Viana do Castelo	1,366	1,105	8,533	2,421	1,575	6,286	592	877	904	0	118,648
30 Vila Franca de Xira	18	4,755	29,874	7,299	2,913	9,149	1,363	4,117	0	0	215,663
31 Vila Real	0	991	478	1,907	157	3,131	202	1,038	640	0	74,472
32 Viseu	0	1,367	4,825	561	97	5,872	1,373	857	541	0	105,733

Notes: (1) - Sectors: L - Real estate activities; M - Professional, scientific and technical activities; N - Administrative and support service activities; O- Public administration and defence; compulsory social security; P - Education; Q - Human health and social work activities; R - Arts, entertainment and recreation; S - Other service activities; T - Activities of households as employers; undifferentiated goods and services producing activities of households for own use; U - Activities of extraterritorial organisations and bodies; (2) 'T DAYSABS' stands for 'Total number of days of absence from work'.

Source: Own elaboration, based on data from the ACT and GEP.

Appendix 11.5 - Fatal work-related accidents incidence rates per 100,000 workers, local branch jurisdiction area and economic sector

ACT LOCAL BRANCHES	IRFWRA_A	IRFWRA_B	IRFWRA_C	IRFWRA_D	IRFWRA_E	IRFWRA_F	IRFWRA_G	IRFWRA_H	IRFWRA_I	IRFWRA_J	IRFWRA_K
1 Almada	77.64	0.00	7.30	0.00	0.00	0.00	3.70	0.00	0.00	0.00	0.00
2 Aveiro	22.74	0.00	8.06	0.00	0.00	16.68	0.00	87.82	0.00	0.00	0.00
3 Barreiro	0.00	0.00	0.00	0.00	0.00	21.18	0.00	23.91	0.00	0.00	0.00
4 Beja	19.05	0.00	11.93	0.00	0.00	14.17	0.00	0.00	0.00	0.00	0.00
5 Braga	19.46	0.00	0.00	0.00	0.00	19.17	0.00	0.00	0.00	0.00	0.00
6 Bragança	17.86	0.00	0.00	0.00	0.00	21.49	0.00	0.00	0.00	0.00	0.00
7 Caldas da Rainha	85.91	0.00	0.00	0.00	0.00	0.00	0.00	89.09	0.00	0.00	0.00
8 Castelo Branco	53.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9 Coimbra	37.55	0.00	6.17	0.00	0.00	18.01	0.00	41.90	0.00	0.00	0.00
10 Covilhã	0.00	0.00	0.00	0.00	0.00	0.00	17.20	0.00	0.00	0.00	0.00
11 Évora	15.50	0.00	0.00	0.00	0.00	0.00	9.54	0.00	0.00	0.00	0.00
12 Faro	24.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.17	0.00	0.00
13 Figueira da Foz	187.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14 Guarda	0.00	0.00	15.85	0.00	0.00	36.70	12.14	0.00	0.00	0.00	0.00
15 Guimarães	0.00	0.00	1.46	0.00	0.00	7.10	3.82	0.00	0.00	0.00	0.00
16 Lamego	17.62	0.00	0.00	0.00	0.00	30.76	0.00	0.00	0.00	0.00	0.00
17 Leiria	37.84	0.00	6.45	0.00	0.00	7.48	0.00	0.00	0.00	0.00	0.00
18 Lisboa	0.00	0.00	4.45	0.00	0.00	5.03	3.66	0.00	0.00	0.00	0.00
19 Penafiel	0.00	137.55	1.62	0.00	0.00	3.31	0.00	0.00	0.00	0.00	0.00
20 Portalegre	26.25	0.00	0.00	0.00	0.00	34.92	15.53	0.00	0.00	0.00	0.00
21 Portimão	0.00	0.00	68.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22 Porto	13.30	0.00	2.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23 Santarém	13.16	153.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24 São João da Madeira	0.00	0.00	0.00	0.00	0.00	9.49	0.00	0.00	0.00	0.00	0.00
25 Setúbal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	51.91	0.00	0.00	0.00
26 Sintra	0.00	0.00	0.00	0.00	0.00	4.99	0.00	7.20	0.00	0.00	6.49
27 Tomar	0.00	0.00	20.81	0.00	0.00	15.75	8.53	0.00	0.00	0.00	0.00
28 Torres Vedras	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29 Viana do Castelo	0.00	0.00	5.88	0.00	0.00	30.24	13.17	0.00	0.00	0.00	0.00
30 Vila Franca de Xira	51.28	0.00	4.32	0.00	0.00	8.35	2.76	13.11	0.00	0.00	0.00
31 Vila Real	0.00	0.00	0.00	0.00	0.00	0.00	8.99	0.00	21.36	0.00	0.00
32 Viseu	0.00	0.00	0.00	0.00	0.00	8.86	0.00	27.06	17.05	0.00	0.00

Notes: (1) 'IRFWRA_X' stands for 'Incidence Rate of Fatal Work-Related Accidents in sector X'; (2) - Economic activity sectors: A - Agriculture, forestry and fishing; B - Mining and quarrying; C - Manufacturing; D - Electricity, gas, steam and air conditioning supply; E - Water supply; sewerage, waste management and remediation activities; F - Construction; G - Wholesale and retail trade; repair of motor vehicles and motorcycles; H - Transportation and storage; I - Accommodation and food service activities; J - Information and communication; and K - Financial and insurance activities.

Source: Own calculations, based on GEP data.

Appendix 11.5 - Fatal work-related accidents incidence rates per 100,000 workers, local branch jurisdiction area and economic sector (Cont)

ACT LOCAL BRANCHES	IRFWRA_L	IRFWRA_M	IRFWRA_N	IRFWRA_O	IRFWRA_P	IRFWRA_Q	IRFWRA_R	IRFWRA_S	IRFWRA_T	IRFWRA_U
1 Almada	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2 Aveiro	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3 Barreiro	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4 Beja	0.00	0.00	32.36	9.68	0.00	0.00	0.00	0.00	0.00	0.00
5 Braga	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6 Bragança	0.00	0.00	0.00	57.78	0.00	18.04	0.00	0.00	0.00	0.00
7 Caldas da Rainha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8 Castelo Branco	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9 Coimbra	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10 Covilhã	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11 Évora	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12 Faro	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13 Figueira da Foz	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14 Guarda	0.00	0.00	75.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15 Guimarães	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16 Lamego	0.00	0.00	0.00	28.92	0.00	0.00	0.00	0.00	0.00	0.00
17 Leiria	0.00	0.00	29.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18 Lisboa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.04	0.00
19 Penafiel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20 Portalegre	0.00	90.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21 Portimão	0.00	45.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22 Porto	0.00	0.00	3.72	6.97	0.00	0.00	0.00	0.00	0.00	0.00
23 Santarém	0.00	0.00	0.00	0.00	0.00	0.00	0.00	48.17	0.00	0.00
24 São João da Madeira	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25 Setúbal	0.00	0.00	23.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26 Sintra	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27 Tomar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28 Torres Vedras	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29 Viana do Castelo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30 Vila Franca de Xira	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31 Vila Real	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
32 Viseu	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: Sectors: L - Real estate activities; M - Professional, scientific and technical activities; N - Administrative and support service activities; O- Public administration and defence; compulsory social security; P - Education; Q - Human health and social work activities; R - Arts, entertainment and recreation; S - Other service activities; T - Activities of households as employers; undifferentiated goods and services producing activities of households for own use; U - Activities of extraterritorial organisations and bodies.

Source: Own calculations, based on GEP data.

Appendix 11.6 - Non-fatal work-related accidents incidence rates per 100,000 workers, local branch jurisdiction area and economic sector

ACT LOCAL BRANCHES	IRNFWRA_A	IRNFWRA_B	IRNFWRA_C	IRNFWRA_D	IRNFWRA_E	IRNFWRA_F	IRNFWRA_G	IRNFWRA_H	IRNFWRA_I	IRNFWRA_J	IRNFWRA_K
1 Almada	18,405.28	0.00	1,919.48	0.00	1,175.54	1,513.61	2,088.29	2,541.01	1,402.26	306.81	0.00
2 Aveiro	4,499.27	9,083.09	6,758.80	0.00	8,184.09	6,083.25	3,527.35	7,482.86	2,551.19	233.20	0.00
3 Barreiro	7,413.78	0.00	2,701.99	0.00	7,673.44	1,697.56	2,288.72	1,566.11	1,658.52	0.00	0.00
4 Beja	2,545.07	1,656.95	2,202.81	0.00	3,614.96	4,124.88	1,410.85	3,045.62	1,362.92	1,052.97	0.00
5 Braga	3,135.92	8,718.66	3,983.17	0.00	6,929.10	5,252.35	3,127.17	3,800.21	2,532.58	680.23	889.46
6 Bragança	1,569.91	5,761.87	3,960.04	0.00	4,795.81	6,735.78	2,084.90	3,389.29	1,543.41	1,524.70	0.00
7 Caldas da Rainha	6,212.77	16,499.88	5,176.39	0.00	5,724.48	5,363.72	4,267.37	3,638.12	2,289.09	987.21	0.00
8 Castelo Branco	2,426.10	0.00	1,544.51	0.00	5,886.13	4,192.91	2,053.07	3,148.36	1,819.00	883.05	0.00
9 Coimbra	5,172.96	2,102.10	5,008.28	0.00	7,724.73	5,731.99	2,739.63	4,787.65	1,954.47	546.20	0.00
10 Covilhã	1,748.34	9,004.35	3,088.03	0.00	2,168.46	3,035.24	1,860.56	3,139.50	2,117.38	0.00	0.00
11 Évora	3,072.30	12,311.33	2,982.78	0.00	1,546.97	2,628.59	1,580.13	1,529.71	1,696.54	723.78	0.00
12 Faro	3,336.00	3,241.88	3,213.92	0.00	12,605.86	2,323.41	2,692.41	5,404.54	2,495.42	64.89	0.00
13 Figueira da Foz	4,657.35	5,262.21	3,860.32	0.00	3,546.30	3,536.97	1,858.81	3,619.62	1,143.67	668.41	0.00
14 Guarda	1,398.71	3,391.91	1,958.39	0.00	7,488.02	4,924.70	1,361.77	2,545.30	1,593.75	0.00	0.00
15 Guimarães	4,454.60	6,330.31	4,228.48	756.74	13,459.91	5,932.10	3,903.74	5,596.84	2,396.05	0.00	0.00
16 Lamego	2,189.12	12,340.15	4,328.21	0.00	2,129.37	4,775.37	3,237.74	2,603.97	2,224.26	0.00	1,027.96
17 Leiria	7,314.49	9,541.92	7,310.08	0.00	11,185.83	7,595.44	4,444.82	7,767.57	3,144.05	1,403.93	0.00
18 Lisboa	1,409.34	0.00	3,137.78	0.00	6,755.57	3,998.12	4,704.34	10,043.93	4,691.97	500.34	282.82
19 Penafiel	6,018.79	6,708.68	5,044.54	905.13	2,921.67	4,902.82	3,821.33	7,147.39	3,433.76	350.82	271.59
20 Portalegre	3,763.44	7,587.16	4,057.20	2,318.71	4,143.81	2,686.99	2,027.64	1,341.68	1,447.98	1,941.24	865.53
21 Portimão	1,835.91	3,292.18	2,707.71	0.00	1,629.26	2,246.70	2,278.43	1,236.15	1,901.22	672.70	407.84
22 Porto	3,573.57	1,220.78	4,539.29	158.77	10,015.58	5,889.00	3,087.34	5,106.18	3,566.34	348.41	557.59
23 Santarém	4,797.88	4,101.99	4,813.51	0.00	6,140.53	5,056.32	2,617.33	3,612.28	885.48	574.55	452.41
24 São João da Madeira	6,829.60	0.00	5,800.94	1,112.51	2,820.31	6,255.47	2,820.98	4,635.57	3,547.05	550.73	1,127.80
25 Setúbal	3,830.40	9,290.54	5,110.23	0.00	7,436.69	3,595.65	2,420.13	3,162.52	2,308.72	795.92	0.00
26 Sintra	2,296.06	0.00	2,155.78	0.00	6,580.34	2,975.32	2,264.55	2,322.53	1,649.66	473.28	74.13
27 Tomar	7,202.23	16,166.12	4,456.69	0.00	3,192.83	4,802.39	2,982.21	3,137.23	2,139.78	975.18	0.00
28 Torres Vedras	5,602.38	0.00	4,647.00	0.00	2,577.04	2,202.62	2,825.30	5,357.49	1,474.94	0.00	226.26
29 Viana do Castelo	2,138.96	6,663.18	4,469.71	1,735.55	3,622.65	4,375.18	2,874.50	4,651.10	1,531.62	0.00	0.00
30 Vila Franca de Xira	5,007.75	6,038.61	3,483.39	0.00	18,593.75	2,939.29	2,401.00	4,164.87	1,558.47	315.48	0.00
31 Vila Real	1,431.93	10,284.72	5,854.53	1,360.26	882.45	5,694.15	2,678.40	2,593.87	1,983.85	3,720.63	456.24
32 Viseu	3,564.60	1,186.20	4,839.51	0.00	3,992.92	5,466.31	2,597.26	3,167.97	1,753.51	516.38	463.96

Notes: (1) 'IRNFWRA_X' stands for 'Incidence Rate of Non-Fatal Work-Related Accidents in sector X'; (2) - Sectors: A - Agriculture, forestry and fishing; B - Mining and quarrying; C - Manufacturing; D - Electricity, gas, steam and air conditioning supply; E - Water supply; sewerage, waste management and remediation activities; F - Construction; G - Wholesale and retail trade; repair of motor vehicles and motorcycles; H - Transportation and storage; I - Accommodation and food service activities; J - Information and communication; and K - Financial and insurance activities.

Source: Own calculations, based on GEP data.

Appendix 11.6 - Non-fatal work-related accidents incidence rates per 100,000 workers, local branch jurisdiction area and economic sector (Cont)

ACT LOCAL BRANCHES	IRNFWRA_L	IRNFWRA_M	IRNFWRA_N	IRNFWRA_O	IRNFWRA_P	IRNFWRA_Q	IRNFWRA_R	IRNFWRA_S	IRNFWRA_T	IRNFWRA_U
1 Almada	672.48	321.60	1,157.75	1,192.00	271.33	798.90	1,665.22	442.23	216.27	0.00
2 Aveiro	691.87	362.72	10,342.93	2,930.80	187.53	2,300.56	1,461.68	801.31	790.49	0.00
3 Barreiro	0.00	639.68	2,626.06	908.90	176.05	1,417.20	596.26	297.98	0.00	0.00
4 Beja	0.00	572.59	6,924.43	1,392.93	59.26	1,965.38	937.90	358.05	0.00	0.00
5 Braga	1,669.55	534.89	3,499.19	1,093.60	258.39	1,627.25	7,161.20	2,260.01	1,726.17	0.00
6 Bragança	10,279.28	0.00	2,015.45	1,071.25	88.42	1,210.93	0.00	778.36	762.99	0.00
7 Caldas da Rainha	0.00	855.62	7,090.92	1,379.99	435.03	2,513.14	3,725.10	877.82	2,512.82	0.00
8 Castelo Branco	0.00	0.00	2,738.12	257.80	352.55	1,445.81	0.00	2,324.05	0.00	0.00
9 Coimbra	875.80	361.99	2,072.24	1,337.40	31.21	1,845.67	550.66	3,553.60	0.00	0.00
10 Covilhã	0.00	0.00	2,846.84	668.66	0.00	929.25	3,723.68	2,591.56	0.00	0.00
11 Évora	0.00	317.38	1,787.04	1,398.70	83.30	1,861.98	1,209.24	389.61	0.00	0.00
12 Faro	3,228.14	541.52	2,357.22	1,322.49	201.81	2,596.59	3,114.66	1,628.17	341.24	0.00
13 Figueira da Foz	0.00	2,011.08	5,960.00	398.23	144.00	2,050.23	0.00	651.36	962.63	0.00
14 Guarda	0.00	392.99	1,595.43	945.58	170.32	1,303.72	1,361.18	1,730.15	0.00	0.00
15 Guimarães	3,239.85	436.46	9,471.90	1,513.32	222.61	1,952.79	2,301.21	3,935.10	1,026.54	0.00
16 Lamego	0.00	1,519.78	1,259.97	599.85	0.00	1,280.44	0.00	944.96	2,070.85	0.00
17 Leiria	4,636.02	1,161.34	10,353.40	1,234.85	272.15	2,596.55	2,652.49	2,189.26	1,248.44	0.00
18 Lisboa	1,439.69	781.13	6,630.38	887.10	473.80	3,299.85	1,662.67	2,289.85	810.12	1,319.43
19 Penafiel	2,730.11	1,105.75	4,218.47	1,052.15	375.86	2,123.70	2,454.75	3,166.47	1,206.77	0.00
20 Portalegre	0.00	817.52	4,814.30	1,209.34	0.00	1,248.43	0.00	1,486.33	0.00	0.00
21 Portimão	3,092.12	865.68	2,762.26	3,331.45	0.00	2,414.88	3,980.68	1,439.29	759.03	0.00
22 Porto	2,630.21	916.48	6,969.82	1,837.51	263.72	2,312.66	2,860.59	1,397.14	1,124.48	0.00
23 Santarém	0.00	721.94	3,435.79	559.04	161.98	2,941.56	2,921.27	2,079.58	305.60	0.00
24 São João da Madeira	4,641.84	1,572.47	13,896.42	1,053.59	239.96	2,577.14	704.22	1,402.01	1,744.93	0.00
25 Setúbal	166.67	326.48	11,961.02	3,502.21	120.36	2,167.39	2,184.48	1,483.18	0.00	0.00
26 Sintra	485.20	393.05	2,720.85	734.55	387.40	1,378.77	1,079.46	533.48	518.52	0.00
27 Tomar	0.00	309.28	5,922.80	1,664.87	75.65	2,202.86	2,617.89	7,640.48	1,964.78	0.00
28 Torres Vedras	917.46	247.67	3,613.38	3,164.65	85.94	2,492.50	526.22	1,769.42	760.75	0.00
29 Viana do Castelo	4,863.60	412.63	8,577.87	1,350.10	267.43	1,578.13	1,729.00	2,342.70	1,069.92	0.00
30 Vila Franca de Xira	355.39	1,862.87	4,945.96	1,486.64	299.47	1,576.95	848.65	1,251.21	0.00	0.00
31 Vila Real	0.00	1,460.80	854.22	721.65	67.93	1,366.17	2,143.33	1,770.12	409.62	0.00
32 Viseu	0.00	1,279.75	6,086.85	384.54	54.04	2,314.09	4,844.65	1,397.45	1,186.60	0.00

Notes: Sectors: L - Real estate activities; M - Professional, scientific and technical activities; N - Administrative and support service activities; O - Public administration and defence; compulsory social security; P - Education; Q - Human health and social work activities; R - Arts, entertainment and recreation; S - Other service activities; T - Activities of households as employers; undifferentiated goods and services producing activities of households for own use; U - Activities of extraterritorial organisations and bodies.

Source: Own calculations, based on GEP data.

Appendix 11.7 - Average number of days of absence per non-fatal accident at work, local branch jurisdiction area and economic sector

ACT LOCAL BRANCHES	AVGDAY-SABS_A	AVGDAY-SABS_B	AVGDAY-SABS_C	AVGDAY-SABS_D	AVGDAY-SABS_E	AVGDAY-SABS_F	AVGDAY-SABS_G	AVGDAY-SABS_H	AVGDAY-SABS_I	AVGDAY-SABS_J	AVGDAY-SABS_K
1 Almada	51.78	0.00	44.39	0.00	53.73	71.04	31.66	60.15	53.94	16.53	0.00
2 Aveiro	48.12	19.58	32.45	0.00	37.50	41.98	30.49	36.41	51.26	228.00	0.00
3 Barreiro	60.63	0.00	51.82	0.00	92.34	48.93	26.94	34.24	22.20	0.00	0.00
4 Beja	61.64	43.26	39.14	0.00	33.80	54.43	22.88	71.84	70.77	23.34	0.00
5 Braga	34.95	27.33	33.85	0.00	19.27	40.98	32.63	55.14	37.78	55.82	47.71
6 Bragança	52.82	104.08	49.71	0.00	35.89	54.78	58.90	18.11	39.10	103.00	0.00
7 Caldas da Rainha	31.91	30.17	26.17	0.00	75.31	61.51	26.09	65.62	41.79	65.94	0.00
8 Castelo Branco	24.04	0.00	33.69	0.00	20.84	51.09	46.72	37.35	17.30	121.00	0.00
9 Coimbra	40.00	11.00	31.85	0.00	17.29	36.64	31.34	35.12	27.07	36.84	0.00
10 Covilhã	52.51	48.46	32.84	0.00	10.00	67.60	29.15	52.14	35.50	0.00	0.00
11 Évora	38.82	119.58	50.88	0.00	200.00	49.84	26.91	80.64	31.90	10.00	0.00
12 Faro	38.34	12.71	46.77	0.00	36.78	42.70	27.25	74.68	34.75	6.00	0.00
13 Figueira da Foz	58.46	29.00	20.90	0.00	20.27	52.02	33.29	44.55	18.39	148.00	0.00
14 Guarda	34.97	40.27	32.32	0.00	15.20	38.44	51.78	44.82	26.42	0.00	0.00
15 Guimarães	39.91	108.77	32.61	5.00	24.17	50.18	36.87	42.46	35.44	0.00	0.00
16 Lamego	54.97	24.19	28.40	0.00	28.00	36.55	35.23	29.45	41.42	0.00	15.00
17 Leiria	32.14	65.55	28.06	0.00	22.87	32.85	27.23	36.88	19.48	91.11	0.00
18 Lisboa	24.22	0.00	42.39	0.00	49.02	62.09	29.88	42.74	38.61	48.45	30.25
19 Penafiel	69.03	47.04	36.70	217.23	25.40	36.88	37.19	49.81	30.85	8.00	19.00
20 Portalegre	46.88	20.47	57.82	163.00	99.09	88.44	35.02	109.56	90.79	132.00	169.00
21 Portimão	72.40	15.00	28.46	0.00	12.04	42.05	40.82	21.20	39.04	8.00	17.00
22 Porto	34.72	17.00	35.79	6.00	37.20	40.99	32.20	44.36	33.66	27.00	30.55
23 Santarém	41.38	21.96	36.68	0.00	65.74	51.74	53.70	44.05	21.54	27.50	50.33
24 São João da Madeira	47.93	0.00	33.18	19.00	18.91	34.22	33.63	61.10	40.29	84.00	100.40
25 Setúbal	61.45	171.00	47.66	0.00	22.97	50.71	35.69	46.10	56.00	25.70	0.00
26 Sintra	14.07	0.00	47.86	0.00	31.85	64.98	36.54	51.47	51.99	46.80	74.40
27 Tomar	22.94	35.68	41.39	0.00	26.31	34.95	39.38	34.82	38.49	144.00	0.00
28 Torres Vedras	51.51	0.00	34.20	0.00	17.58	40.90	42.39	52.03	35.75	0.00	20.00
29 Viana do Castelo	40.94	25.79	42.21	8.07	31.07	51.40	35.76	49.03	90.55	0.00	0.00
30 Vila Franca de Xira	94.52	113.76	50.36	0.00	41.16	41.15	38.20	51.82	46.86	59.02	0.00
31 Vila Real	60.09	41.25	32.23	65.00	342.00	64.78	33.15	28.99	43.00	15.64	51.00
32 Viseu	34.64	7.00	34.40	0.00	34.00	42.87	43.22	32.94	29.34	6.00	37.00

Notes: (1) 'AVGDAY_SABS_X' stands for 'Average Number of Days of Absence from work in sector X'; (2) - Sectors: A - Agric., forest. & fish.; B - Mining & quarrying; C - Manufact.; D - Electr., gas, steam & AC sup.; E - Water supply, sewer. & waste manag.; F - Construction; G - Wholesale and retail trade; H - Transp. & storage; I - Accom. & food serv.; J - Inf. & com.; K - Fin. & insur. activ.

Source: Own calculations, based on GEP data.

Appendix 11.7 - Average number of days of absence per non-fatal accident at work, local branch jurisdiction area and economic sector (Cont)

ACT LOCAL BRANCHES	AVGDAY-SABS_L	AVGDAY-SABS_M	AVGDAY-SABS_N	AVGDAY-SABS_O	AVGDAY-SABS_P	AVGDAY-SABS_Q	AVGDAY-SABS_R	AVGDAY-SABS_S	AVGDAY-SABS_T	AVGDAY-SABS_U
1 Almada	25.00	12.31	41.51	46.30	198.61	52.85	16.75	22.40	145.00	0.00
2 Aveiro	283.00	52.94	34.57	51.35	30.41	34.25	9.34	20.69	127.67	0.00
3 Barreiro	0.00	6.98	44.05	38.19	107.39	55.87	36.00	12.00	0.00	0.00
4 Beja	0.00	15.70	39.80	40.95	47.00	33.40	151.00	84.00	0.00	0.00
5 Braga	19.02	86.18	43.43	38.88	46.86	49.87	38.69	23.41	53.45	0.00
6 Bragança	190.22	0.00	23.17	56.97	32.00	23.00	0.00	207.00	80.00	0.00
7 Caldas da Rainha	0.00	20.45	38.06	20.07	19.61	33.73	10.91	30.57	37.07	0.00
8 Castelo Branco	0.00	0.00	31.38	65.60	18.63	23.22	0.00	12.39	0.00	0.00
9 Coimbra	45.00	28.45	36.64	48.16	5.00	24.36	32.00	25.16	0.00	0.00
10 Covilhã	0.00	0.00	18.69	28.63	0.00	42.51	28.00	51.64	0.00	0.00
11 Évora	0.00	32.54	51.93	35.48	15.00	50.90	13.00	22.00	0.00	0.00
12 Faro	35.56	33.83	37.16	31.19	92.07	28.43	61.19	59.92	152.00	0.00
13 Figueira da Foz	0.00	20.46	45.88	35.79	11.00	31.84	0.00	34.00	20.00	0.00
14 Guarda	0.00	30.00	131.26	30.11	7.03	21.60	26.00	7.38	0.00	0.00
15 Guimarães	38.23	18.69	27.86	64.12	22.90	34.99	26.28	24.84	95.92	0.00
16 Lamego	0.00	25.54	23.54	47.65	0.00	46.62	0.00	34.00	134.63	0.00
17 Leiria	11.42	19.12	17.57	34.39	45.40	24.22	17.08	13.16	39.58	0.00
18 Lisboa	63.34	37.44	38.95	70.75	71.20	43.77	74.01	36.50	63.29	260.00
19 Penafiel	65.98	35.90	41.90	41.81	24.30	39.12	23.65	39.77	85.23	0.00
20 Portalegre	0.00	58.27	40.65	43.24	0.00	100.60	0.00	24.11	0.00	0.00
21 Portimão	69.06	192.19	55.00	26.78	0.00	43.60	49.11	53.85	144.00	0.00
22 Porto	27.80	37.75	33.24	61.72	31.14	40.04	40.98	30.85	87.09	0.00
23 Santarém	0.00	53.42	38.09	55.29	21.79	46.54	19.93	23.85	78.00	0.00
24 São João da Madeira	16.52	95.52	27.91	54.56	43.47	38.76	10.00	46.93	29.79	0.00
25 Setúbal	126.00	233.88	36.81	36.26	8.23	50.29	131.51	23.32	0.00	0.00
26 Sintra	138.32	36.51	59.09	63.34	46.34	43.14	49.46	51.34	26.67	0.00
27 Tomar	0.00	204.00	20.55	36.23	6.00	49.75	34.74	32.64	112.54	0.00
28 Torres Vedras	55.00	20.22	75.40	55.09	50.00	54.80	262.00	51.98	53.96	0.00
29 Viana do Castelo	75.52	103.03	38.42	28.49	72.05	56.88	53.28	21.62	45.28	0.00
30 Vila Franca de Xira	4.00	30.84	47.68	34.13	75.30	43.33	99.80	72.82	0.00	0.00
31 Vila Real	0.00	36.45	30.44	39.08	27.00	32.54	18.83	43.56	111.00	0.00
32 Viseu	0.00	36.15	27.58	19.08	16.00	27.42	48.95	34.30	24.53	0.00

Notes: Sectors: L - Real estate activ.; M - Prof., scient. & techn. activ.; N - Adm. & supp. serv. active.; O- Public adm. & defence; P - Education; Q - Human health & social work activ.; R - Arts, entert. & recreat.; S - Other serv.; T - Activ. of households; U - Activ. of extraterr. organiz. & bodies.
Source: Own calculations, based on GEP data.

Appendix 11.8 - Additional data on resources, costs and outputs

ACT LOCAL BRANCHES	DIRTIMALL (%)	WRKLI	LIEDU	STFEDU	LISEN	STFSEN	LIAVGTRA	STFAVGTRA	LIAVGALW (€)	LIAVGREM (€)	FIRSINSPVIS	FOLLINSPVIS
1 Almada	100	14,687.18	16.45	14.24	10.45	15.15	8.73	3.84	558.76	32,545.24	893	446
2 Aveiro	100	12,059.57	17.00	16.07	10.74	13.02	20.21	14.72	610.31	34,533.68	1,013	579
3 Barreiro	100	15,911.40	17.20	14.53	8.48	9.56	32.20	10.73	200.30	28,632.96	599	199
4 Beja	100	7,954.91	16.00	15.55	10.15	10.70	9.09	4.55	287.78	28,768.95	392	38
5 Braga	100	11,500.12	17.41	15.00	12.32	13.69	11.06	5.22	344.72	37,076.56	1,052	402
6 Bragança	100	9,391.60	15.00	15.50	21.31	16.68	43.40	18.08	1,095.66	38,531.06	381	204
7 Caldas da Rainha	33	13,363.23	17.00	16.25	6.22	6.57	5.63	4.95	748.77	28,048.06	405	174
8 Castelo Branco	100	6,651.00	17.00	15.50	6.54	8.72	17.17	11.00	406.44	29,809.68	387	329
9 Coimbra	67	8,808.93	17.33	16.00	19.02	16.12	4.09	2.17	260.46	37,625.68	798	289
10 Covilhã	100	6,864.00	17.00	17.00	10.26	9.65	36.80	33.00	327.35	29,911.38	413	189
11 Évora	100	11,332.67	17.67	14.17	16.08	14.81	8.33	2.78	254.21	36,316.05	562	173
12 Faro	100	10,921.18	17.09	14.92	9.45	14.99	8.45	4.68	586.54	32,545.47	1,021	341
13 Figueira da Foz	33	14,185.59	17.00	14.22	11.65	13.25	0.00	4.72	288.93	32,826.78	187	87
14 Guarda	100	7,508.57	16.71	14.06	15.49	15.68	6.14	4.50	449.34	35,066.58	402	85
15 Guimarães	100	11,829.71	16.29	14.56	14.40	17.88	12.57	12.00	280.27	35,257.16	726	396
16 Lamego	33	11,502.40	18.00	14.43	13.24	12.32	2.77	1.26	648.99	31,652.22	114	22
17 Leiria	100	10,388.67	17.67	15.38	14.12	12.89	22.50	12.50	477.09	35,833.95	991	385
18 Lisboa	100	8,806.43	16.52	15.12	15.52	16.07	6.52	4.73	462.69	37,643.39	3,785	1,710
19 Penafiel	100	18,698.20	17.80	16.88	9.52	10.61	16.50	9.71	356.03	31,779.61	600	177
20 Portalegre	100	14,184.67	13.33	12.50	27.02	18.78	0.00	0.00	580.96	35,849.45	225	65
21 Portimão	100	9,436.86	17.29	15.82	11.08	14.63	1.14	0.73	263.25	31,042.10	688	237
22 Porto	100	14,836.82	17.28	15.91	12.68	13.43	5.79	3.49	306.83	35,362.40	3,742	1,176
23 Santarém	67	9,848.50	15.42	14.48	17.68	18.77	7.03	3.62	679.40	32,652.21	1,387	302
24 São João da Madeira	100	11,465.36	17.36	15.29	7.96	10.45	30.27	23.00	184.27	27,379.22	878	336
25 Setúbal	100	6,470.69	16.46	15.39	14.13	14.92	6.31	4.64	263.70	30,707.59	1,198	521
26 Sintra	100	17,729.11	17.05	16.64	10.54	9.32	9.89	7.76	653.12	33,819.77	2,445	1,325
27 Tomar	33	14,599.08	15.75	12.92	12.28	16.40	6.23	2.19	513.79	29,827.45	459	161
28 Torres Vedras	67	11,924.77	16.38	14.60	16.73	15.32	16.95	8.86	571.92	33,200.79	698	390
29 Viana do Castelo	100	10,199.33	17.00	15.56	7.98	12.81	18.56	9.28	354.42	31,644.25	1,000	291
30 Vila Franca de Xira	100	15,818.92	17.08	15.37	5.90	9.68	14.83	9.37	439.55	27,617.75	1,411	524
31 Vila Real	67	12,693.65	16.00	14.60	13.99	14.64	9.83	5.78	380.50	31,563.58	254	55
32 Viseu	100	11,639.44	16.89	14.08	13.89	14.81	15.00	5.40	307.15	31,574.66	562	268

Notes: DIRTIMALL (%) - Percentage of the director's time allocated to the local branch management; WRKLI - Average number of workers served per labour inspector (LI); LIEDU - LI average number of years of completed education; STFEDU - Staff average number of years of completed education; LISEN - LI average seniority in the career (in years); STFSEN - Staff average seniority in the current career; LIAVGTRA - LI average number of training hours; STFAVGTRA - Staff average number of training hours; LIAVGALW - LI average annual costs with daily allowances; LIAVGREM - LI average annual costs with remuneration; FIRSINSPVIS - Number of first Inspection Visits (IV); and FOLLINSPVIS - Number of follow-up IV .

Sources: Own elaboration, based on data from the ACT and INE (2013).

Appendix 11.8 - Additional data on resources, costs and outputs (Cont)

ACT LOCAL BRANCHES	LRINSPVIS	OSHINSPVIS	LROSHINSPVIS	INSPMPYER	INSPWRKPL	RECNOT	WARNOT	OTHAUTNOT	DEBTNOT	FINVOLUNT	FINCOERC	FINCOURTS
1 Almada	327	193	819	784	1,206	9	59	32	58	168	258	74
2 Aveiro	691	320	581	988	1,364	1	6	5	39	287	601	689
3 Barreiro	260	197	341	568	690	5	82	20	33	181	103	449
4 Beja	157	90	183	372	418	1	0	21	20	319	320	133
5 Braga	525	158	771	998	1,324	0	22	10	46	198	583	115
6 Bragança	164	123	298	374	507	0	75	7	33	63	205	60
7 Caldas da Rainha	150	130	299	385	493	0	111	9	32	98	674	142
8 Castelo Branco	122	130	464	371	626	0	375	4	33	89	152	118
9 Coimbra	276	314	497	712	1,006	0	115	28	12	166	331	88
10 Covilhã	252	165	185	371	529	2	42	14	21	116	123	37
11 Évora	160	201	374	544	695	2	30	13	50	202	268	42
12 Faro	491	249	622	961	1,249	5	40	23	17	232	317	22
13 Figueira da Foz	59	48	167	174	260	4	54	12	8	49	143	160
14 Guarda	186	64	237	384	453	1	59	10	13	184	277	117
15 Guimarães	231	122	769	749	1,035	2	74	7	21	293	1,237	45
16 Lamego	24	38	74	117	131	1	0	8	0	81	163	52
17 Leiria	498	344	534	1,004	1,286	16	59	25	70	287	272	179
18 Lisboa	1,724	527	3,244	2,914	5,169	65	255	101	93	592	16	13
19 Penafiel	257	114	406	573	703	1	17	13	35	205	240	79
20 Portalegre	120	65	105	226	277	0	2	0	26	81	137	55
21 Portimão	223	70	632	631	849	17	12	9	13	177	159	59
22 Porto	2,017	920	1,981	3,343	4,301	5	384	349	169	640	930	22
23 Santarém	790	418	481	1,184	1,451	10	36	32	29	284	439	92
24 São João da Madeira	325	219	670	837	1,095	0	112	43	84	347	585	31
25 Setúbal	549	357	813	1,068	1,539	17	47	46	53	251	475	144
26 Sintra	1,158	357	2,255	2,087	3,350	8	113	68	39	8	4	2
27 Tomar	198	91	331	417	583	0	21	9	2	81	229	58
28 Torres Vedras	346	222	520	641	910	0	101	85	77	138	269	22
29 Viana do Castelo	317	131	843	979	1,192	0	51	71	70	241	369	6
30 Vila Franca de Xira	606	287	1,042	1,170	1,820	2	58	41	62	221	314	201
31 Vila Real	97	31	181	256	293	1	39	3	16	173	402	166
32 Viseu	254	217	359	613	767	3	189	6	42	175	262	84

Notes: LRINSPVIS - Number of Labour Relations (LR) Inspection Visits (IV); OSHINSPVIS - Number of OSH IV; LROSHINSPVIS - Number of both LR and OSH IV; INSPMPYER - Number of inspected employers; INSPWRKPL - Number of inspected workplaces; RECNOT - Number of recommendation notices; WARNOT - Number of warning notices; OTHAUTNOT - Number of notifications to other competent authorities; DEBTNOT - Number of debt notices; FINVOLUNT - Number of fines collected voluntarily; FINCOERC - Number of fines collected coercively; FINCOURTS - Number of fines collected through courts

Sources: Own elaboration, based on ACT data.

Appendix 11.9 - ACT local branches' outcome levels before the DEA non-negativity adjustment protocol

ACT LOCAL BRANCHES	PFWRA_BA	PNFWRA_BA	PDAYSAbs_BA
1 Almada	-43.30	-8,311.06	-75,177.89
2 Aveiro	-89.96	-40,493.97	473,288.16
3 Barreiro	0.25	-3,883.26	-405,375.98
4 Beja	-41.85	-5,448.59	-121,247.86
5 Braga	6.71	-31,100.13	631,814.83
6 Bragança	-69.83	-19,793.38	-1,844,704.44
7 Caldas da Rainha	-129.66	-41,770.48	703,220.50
8 Castelo Branco	-8.28	-1,292.46	304,873.03
9 Coimbra	-58.29	-18,617.59	687,313.85
10 Covilhã	28.14	-9,142.86	249,550.10
11 Évora	20.30	-7,340.40	-918,816.08
12 Faro	15.78	-22,931.19	122,797.53
13 Figueira da Foz	-141.93	-12,552.18	364,483.70
14 Guarda	-94.54	-4,382.93	346,761.76
15 Guimarães	32.96	-43,379.56	313,898.49
16 Lamego	-31.95	-14,753.02	580,263.39
17 Leiria	-35.46	-58,273.66	1,334,972.41
18 Lisboa	22.15	-27,339.26	-335,119.95
19 Penafiel	-97.14	-32,181.58	-3,689.96
20 Portalegre	-121.94	-13,978.30	-801,547.63
21 Portimão	-68.62	-9,074.51	-7,110.07
22 Porto	18.49	-30,596.46	377,319.17
23 Santarém	-169.60	-18,400.07	153,938.59
24 São João da Madeira	35.85	-35,554.55	468,794.78
25 Setúbal	-30.29	-32,083.60	-1,140,815.53
26 Sintra	26.66	-1,243.93	-46,389.62
27 Tomar	0.26	-39,674.28	738,714.23
28 Torres Vedras	45.34	-10,712.05	-238,483.08
29 Viana do Castelo	-3.94	-26,474.82	183,576.67
30 Vila Franca de Xira	-34.48	-29,350.75	-637,886.62
31 Vila Real	14.99	-17,955.90	125,194.47
32 Viseu	-7.62	-17,317.60	448,793.34

Notes: PFWRA_BA - Number of prevented (allowed) fatal work-related accidents per 100,000 workers before non-negativity adjustment; PNFWRA_BA - Number of prevented (allowed) non-fatal work-related accidents per 100,000 workers before non-negativity adjustment; PDAYSABS_BA - Number of prevented (allowed) days of absence from work per 100,000 workers.

Sources: Own elaboration, based on data from the ACT, GEP (2015), INE (2013) and Eurostat (2016).

Appendix 12 - EMS Outputs

Appendix 12.1 - Resource Efficiency DEA Model 1 under CRS

DMU	Score	LI {I}{V}	TO {I}{V}	TA {I}{V}	OA {I}{V}	SRVCAR {I}{V}
1	148.23%	0.61860761	0.15644417	0	0	0.22494822
2	100.00%	0.43028571	0.23118401	0.15412267	0	0.18440761
3	100.00%	0.98857014	0.01142986	0	0	0
4	175.86%	0.70379644	0.16156558	0.13463798	0	0
5	150.41%	0.50980853	0.22214191	0.14809461	0	0.11995495
6	118.64%	1	0	0	0	0
7	100.00%	0.4927668	0.18418863	0.13814147	0	0.1849031
8	108.34%	0.70413295	0.11834682	0.17752023	0	0
9	149.62%	0.7458058	0	0	0	0.2541942
10	100.00%	0.71428571	0.14285714	0.14285714	0	0
11	100.00%	0.77001274	0.22998726	0	0	0
12	132.03%	0.6644566	0.06261521	0.03130761	0	0.24162058
13	110.15%	0.76905312	0.23094688	0	0	0
14	143.96%	0.77777777	0.22222222	0.00000001	0	0
15	103.97%	0.58333334	0.20833333	0.20833333	0	0
16	125.27%	0.71217949	0.21386772	0.07395279	0	0
17	100.00%	0.75	0	0	0	0.25
18	129.36%	0.62063335	0.09925578	0.13234103	0	0.14776984
19	144.17%	0.5323803	0.13195955	0.17594607	0	0.15971409
20	132.38%	100,000,000	0	0	0	0
21	115.11%	0.7	0.1	0.2	0	0
22	100.00%	0.61971082	0.09920639	0.10629256	0	0.17479023
23	102.16%	0.74023075	0.00604834	0	0	0.25372091
24	100.00%	0.6875	0.125	0.1875	0	0
25	100.00%	0.76470587	0.00000001	0.00000001	0	0.23529411
26	100.00%	0.63333335	0.13333334	0.06666667	0	0.16666665
27	116.66%	0.68404576	0.00000002	0.00000001	0	0.31595422
28	105.75%	0.57562367	0.07735151	0.154703	0	0.19232182
29	100.00%	0.75	0	0	0	0.25
30	100.00%	0.68454623	0.05704552	0.07233617	0	0.18607208
31	100.00%	0.58634954	0.20682523	0	0	0.20682523
32	100.00%	0.85435063	0.07842658	0.06722278	0	0.00000001

Appendix 12.1 - Resource Efficiency DEA Model 1 under CRS (Cont)

DMU	WRAINQ {O}{V}	SUSPNOT {O}{V}	FINCOL {O}{V}	INFRNOT {O}{V}	IMPRNOT {O}{V}	OTHNOT {O}{V}	AREA {O}{V}	INSPVIS {O}{V}	WRKCOVINS {O}{V}	WRINFSRV {O}{V}	PRINFSRV {O}{V}	PHINFSRV {O}{V}	COVINFAW {O}{V}	Benchmarks
1	0.003852	0.00315164	0.17509087	0.11065743	0.15653124	0.05532872	0.00000631	0.46889335	0.00600795	0.00034318	0.00656357	0.00268706	0.01089299	3 (0.82500001) 30 (0.52499999)
2	0.00428473	0.0035706	0.37538952	0.00324604	0.01217264	0.00121726	0.00002148	0.03799774	0.11392957	0.00968242	0.16698796	0.03759994	0.23392158	2
3	0.00196994	0.00236392	0.28879261	0.10440661	0.07059428	0.01833618	0.00000867	0.1045162	0.38994934	0.01252972	0.00294121	0.00013097	0.00346903	13
4	0.01593228	0.00749755	0.72351308	0.24741898	0.00079662	0.00039362	0.00064905	0.00402993	0.00009632	0.00001305	0.00005995	0.00007602	0.0001726	7 (1.22167919) 24 (0.40804087)
5	0.00430731	0.00307665	0.27566777	0.04737272	0.04180931	0.00994246	0.00002827	0.1853376	0.10221701	0.00413975	0.13547579	0.02049221	0.17016142	2 (0.40111033) 3 (0.46745092) 10 (0.63318616) 30 (0.12125160) 32 (0.20470409)
6	0.37272725	0.20965908	0.12229952	0.02935227	0.03727273	0.02678977	0.0076875	0.13627841	0.01308612	0.00045125	0.00883454	0.00315167	0.04009739	11 (0.09605935) 24 (0.17704213) 29 (0.27513117)
7	0.01116509	0.00609005	0.92771673	0.00339626	0.0349815	0.01032463	0.00005364	0.00587694	0.00013313	0.00000068	0.00011262	0.00000166	0.00020071	7
8	0.00525104	0.0028642	0.17137483	0.09690555	0.168988	0.1966753	0.01214661	0.34179493	0.00471957	0.0001273	0.00349115	0.00117591	0.00663222	3 (0.33783784) 24 (0.39189189)
9	0.09316514	0.22020852	0.05345184	0.03124877	0.03387823	0.01312782	0.00126027	0.0920641	0.25718217	0.02056304	0.04426236	0.02249262	0.11835539	3 (0.22370764) 17 (0.02596816) 29 (0.58295720) 32 (0.74781156)
10	0.00214542	0.00078015	0.05383063	0.02184432	0.03608213	0.01540804	0.0018909	0.1174132	0.46575202	0.00431161	0.1972973	0.08148406	0.00365112	4
11	0.18241038	0.11520655	0.13862049	0.02649751	0.03187382	0.00912052	0.0034706	0.07056402	0.09343745	0.00593551	0.07731464	0.07425335	0.17476578	2
12	0.14318711	0.09545808	0.08251597	0.07023251	0.06965446	0.01228346	0.00212143	0.19682444	0.17595799	0.0135382	0.03129096	0.01210208	0.09695474	3 (0.83031520) 24 (0.27875868) 29 (0.12221010) 30 (0.06141633) 32 (0.12335112)
13	0.10485042	0.00434072	0.76396625	0.01127142	0.01664501	0.01022292	0.00065335	0.03591127	0.02678394	0.0004312	0.02138569	0.00284424	0.00134692	3 (0.32825958) 7 (0.08997142) 24 (0.06649923)
14	0.07376045	0.04097802	0.76929515	0.01180169	0.01721077	0.00680235	0.00202104	0.0399126	0.03629685	0.0015409	0.00075405	0.00026228	0.00138488	3 (0.59190867) 7 (0.36921187) 24 (0.06307564)
15	0.00696423	0.00435264	0.68554119	0.02829685	0.0082782	0.00352841	0.00001889	0.03806613	0.12698887	0.00174159	0.08264623	0.01240598	0.00118968	7 (0.94972279) 10 (0.06307812) 24 (0.74052298)
16	0.0163543	0.00545143	0.80681235	0.16574731	0.00128109	0.00024531	0.00028961	0.00370698	0.00006914	0.0000218	0.00011121	0.00004561	0.00017308	3 (0.23292402) 7 (0.03924642) 24 (0.16157221)
17	0.26370998	0.00026371	0.04865449	0.01984418	0.02505245	0.01120767	0.00080695	0.09071623	0.39121375	0.02250325	0.044854	0.01290796	0.06907233	2
18	0.00122913	0.00165665	0.03318648	0.04440896	0.0684037	0.02746836	0.0000004	0.29365493	0.34756207	0.02290045	0.04345725	0.00260083	0.11347119	10 (0.85746156) 22 (0.19143727) 30 (1.66608389) 32 (0.69775452)
19	0.01121849	0.00420693	0.36740544	0.15658002	0.00602979	0.0059398	0.00059847	0.06992759	0.24017172	0.00003	0.13694528	0.00000024	0.00154255	2 (0.02590708) 3 (0.06205427) 7 (0.19699575) 30 (0.65883964)
20	0.27501453	0.11786325	0.30204738	0.02946584	0.04046642	0.01100058	0.01227743	0.11393459	0.01815007	0.00067816	0.02051747	0.01652248	0.05433923	3 (0.33862669) 11 (0.09204877) 24 (0.06859621)
21	0.00583973	0.00089842	0.17743805	0.08804521	0.10736125	0.02290972	0.00462687	0.41551949	0.10212337	0.00051032	0.01712509	0.01101109	0.05121824	10 (0.22619320) 24 (0.28378355) 30 (0.20400583)
22	0.00194157	0.00064719	0.04683309	0.03583084	0.03185944	0.02668192	0.0000015	0.14467659	0.65633003	0.01465985	0.03668633	0.00007992	0.00377322	1
23	0.35664321	0.00050578	0.08244216	0.05047686	0.05098264	0.0108237	0.00254205	0.17085253	0.16385102	0.00383055	0.03647207	0.01131336	0.06180613	3 (0.05240547) 17 (0.04876149) 24 (0.47023620) 30 (0.44964771) 32 (0.01590472)
24	0.41800592	0.05765598	0.3363966	0.04144025	0.03711605	0.01722473	0.0003517	0.08749296	0.00152596	0	0.00139912	0.00010186	0.00164055	13
25	0.1124387	0.1124387	0.06227006	0.0232618	0.06742344	0.01166669	0.00023138	0.12303703	0.48308199	0.00001503	0.00128907	0.00002529	0.00305219	0
26	0.00249615	0.00231786	0.00249615	0.12694722	0.13853651	0.04065164	0.00000412	0.67217841	0.00635806	0.00000475	0.00364379	0.00019791	0.00417155	0
27	0.23582445	0.00068569	0.12616267	0.04251132	0.08159431	0.01097066	0.0022147	0.21255659	0.0744947	0.00089385	0.07676201	0.01576226	0.12178147	3 (0.28630621) 24 (0.21013232) 32 (0.06339735)
28	0.00289928	0.00253687	0.15547412	0.11488414	0.17794357	0.09531397	0.00194432	0.39430132	0.01570086	0.00006493	0.01653643	0.00116585	0.02317867	3 (0.27914614) 7 (0.02686724) 24 (0.19541734) 30 (0.33178958)
29	0.27953237	0.27953237	0.0637748	0.04845228	0.03178387	0.01987786	0.00114815	0.13365789	0.04184096	0.00103217	0.03708992	0.00812077	0.05530474	3
30	0.13758318	0.00108564	0.1331724	0.13751497	0.02189921	0.01252481	0.0001896	0.14868413	0.39267466	0.0109368	0.00093104	0.00088186	0.00211129	8
31	0.00117771	0.00235541	0.87267959	0.11863144	0.00055352	0.00069485	0.00025362	0.00363911	0.00008951	0.00000016	0.00006085	0.00001916	0.00009869	0
32	0.00022822	0.00057056	0.01981692	0.00585759	0.03480323	0.00912872	0.00066354	0.03157014	0.19115782	0.0030429	0.2955041	0.01266609	0.3956537	6

Appendix 12.1 - Resource Efficiency DEA Model 1 under CRS (Cont)

DMU	{S} LI {I}	{S} TO {I}	{S} TA {I}	{S} OA {I}	{S} SRVCAR {I}	{S} WRAINQ {O}	{S} SUSPNOT {O}	{S} FINCOL {O}	{S} INFRNOT {O}	{S} IMPRNOT {O}	{S} OTHNOT {O}	{S} AREA {ON}	{S} INSPVIS {O}	{S} WRKCO-VINSP {O}	{S} WRIN-FSRV {O}	{S} PRINFSRV {O}	{S} PHINFSRV {O}	{S} COVIN-FAW {O}
1	0	0	106,793,489	100,706,509	0	0.00000008	0.00000008	0.00000011	0.00000011	0.00000011	0.00000011	432,884,468	0.00000011	0.00021642	0.00021157	0.00022184	0.00020786	0.00010529
2																		
3																		
4	0.00000001	0.00000001	0.00000001	0.00000001	192,447,800	0.00000074	0.00000074	0.00000074	0.00000074	0.0000739	0.00007391	0.01478272	0.00007391	0.01636758	0.01818119	0.01926796	0.01896817	0.01951916
5	0	0	0	291,843,680	0	0.00000001	0.00000001	0.00000001	0.00000001	0.00000002	0.00000002	0.00017156	0.00000002	0.00000029	0.00000029	0.00000029	0.00000029	0.00000029
6	0	0.10026759	0.11803306	209,055,391	117,825,994	0	0	0.00000003	0.00000001	0.00000009	0.00000009	0.00001802	0.00000009	0.00000653	0.00000498	0.00000433	0.00000426	0.00000409
7																		
8	0	0	0	0.27027027	141,891,892	0.00000001	0	0.00000001	0.00000001	0.00000001	0.00000001	0.00000121	0.00000001	0.00000041	0.00000101	0.00000168	0.00000267	0.00000477
9	0	0.27844788	115,253,150	275,679,015	0	0	0	0.00000017	0.00000016	0.00000012	0.00000012	0.0000244	0.00000012	0.00000042	0.00000042	0.00000261	0.00000279	0.00000273
10																		
11																		
12	0	0.00000001	0	0.52087276	0	0	0	0.00000006	0.00000005	0.00000005	0.00000006	0.00001296	0.00000006	0.00000032	0.00000031	0.00000092	0.00000098	0.00000081
13	0	0	155,098,850	0.61528323	0.56928149	0	0.00000003	0.00000003	0.00000045	0.00000045	0.00000045	0.00009055	0.00000045	0.00000724	0.00000729	0.00000731	0.00000735	0.00056591
14	0.00000001	0.00000001	0.08642257	141,027,823	0.23354751	0.00000001	0.00000012	0.00000065	0.00001521	0.00000686	0.0000067	0.0018149	0.00000901	0.00004329	0.00003812	0.0031199	0.0025866	0.00530603
15	0.00000002	0.00000002	0.00000002	225,947,694	201,230,557	0.0000017	0.00000172	0.00000172	0.00000948	0.00002383	0.00002386	0.02617242	0.00002388	0.00007173	0.00007218	0.00007416	0.00007434	0.47340215
16	0	0	0	0.60550377	0.57644626	0	0	0	0	0.00000023	0.00000031	0.00006565	0.00000023	0.00324994	0.0020124	0.00058772	0.00049153	0.00001322
17																		
18	0	0	0	0.52386189	0	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.52226021	0.00000001	0.00000004	0.00000004	0.00000008	0.00000008	0.00000008
19	0	0.00000001	0.00000001	0.00000001	0	0.00000074	0.00000008	0.00000055	0.00000084	0.00000327	0.0000032	0.00090399	0.00000357	0.00001965	0.00002009	0.00001535	0.01349261	0.00477469
20	0	0.69944215	200,490,280	339,320,541	0.43358295	0	0.00000001	0.00000052	0.00000015	0.00000015	0.00000014	0.0000275	0.00000014	0.00003192	0.00003031	0.00002721	0.00002919	0.00002852
21	0	0	0	0.71621645	0.59645608	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000113	0.00000001	0.00000016	0.00000019	0.00000023	0.00000022	0.00000024
22																		
23	0	0	222,355,209	134,630,567	0	0	0.00000002	0.00000001	0.00000001	0.00000001	0.00000001	0.00000234	0.00000001	0.00000012	0.00000011	0.00000018	0.00000017	0.00000017
24																		
25																		
26																		
27	0	0.10397709	227,497,562	0.48283065	0.00000001	0.00000001	0.0000065	0.00000366	0.00000385	0.00000381	0.00000378	0.00058406	0.00000382	0.00005999	0.00005516	0.00005291	0.00005227	0.00005283
28	0	0.00000001	0.00000001	0.5254365	0.00000001	0.00000084	0.00000085	0.00000084	0.00000085	0.00000085	0.00000085	0.00020575	0.00000101	0.00026489	0.00024197	0.0002339	0.00024131	0.00025139
29																		
30																		
31																		
32																		

Appendix 12.2 - Resource Efficiency DEA Model 1 under VRS

DMU	Score	LI {I}{V}	TO {I}{V}	TA {I}{V}	OA {I}{V}	SRVCAR {I}{V}
1	135.29%	0.72980058	0.00481754	0	0	0.26538188
2	100.00%	0.47001769	0.1971277	0.13141846	0	0.20143615
3	100.00%	0.94765609	0.0523439	0.00000001	0	0
4	158.62%	0.99999989	0.00000006	0.00000005	0	0
5	144.17%	0.64624914	0.12101535	0.0806769	0	0.15205862
6	100.00%	0.86450385	0.08129769	0.05419846	0	0
7	100.00%	0.43878369	0.22661116	0.16995837	0	0.16464679
8	100.00%	0.61995612	0.20665204	0.17339184	0	0
9	135.66%	0.7458058	0	0	0	0.2541942
10	100.00%	0.7142857	0.14285714	0.14285714	0	0.00000002
11	100.00%	0.79701851	0.20298149	0	0	0
12	121.81%	0.73333333	0	0	0	0.26666667
13	100.00%	0.67039504	0.13660855	0	0	0.19299642
14	143.08%	0.77777778	0.22222222	0	0	0
15	100.00%	0.7368421	0.26315789	0.00000001	0	0
16	100.00%	0.72667758	0.09110747	0.18221495	0	0
17	100.00%	0.75	0	0	0	0.25
18	111.94%	0.65624999	0.1875	0.00000001	0	0.15625
19	144.14%	0.53082228	0.13282759	0.17710345	0	0.15924668
20	100.00%	0.99999715	0.00000029	0.00000035	0.00000003	0.00000219
21	109.40%	0.78650714	0.11235814	0.10113471	0	0
22	100.00%	0.66893486	0.15777637	0.11389262	0.00936669	0.05002946
23	101.88%	0.74473517	0.00000001	0	0	0.25526482
24	100.00%	0.6875	0.125	0.1875	0	0
25	100.00%	0.76470588	0	0	0	0.23529412
26	100.00%	0.76	0.16	0.08	0	0
27	100.00%	0.67781371	0.00910836	0	0	0.31307793
28	103.01%	0.53945049	0.12300343	0.14360222	0	0.19394386
29	100.00%	0.75	0	0	0	0.24999999
30	100.00%	0.8437393	0.07031161	0.08594909	0	0
31	100.00%	0.58634953	0.20682523	0	0	0.20682523
32	100.00%	0.99999995	0.00000002	0.00000001	0	0.00000001

Appendix 12.2 - Resource Efficiency DEA Model 1 under VRS (Cont)

DMU	WRAINQ {O}{V}	SUSPNOT {O}{V}	FINCOL {O}{V}	INFRNOT {O}{V}	IMPRNOT {O}{V}	OTHNOT {O}{V}	AREA {ON}{V}	INSPVIS {O}{V}	WRKCOVINS {O}{V}	WRINFSRV {O}{V}	PRINFSRV {O}{V}	PHINFSRV {O}{V}	COVINFAW {O}{V}	Benchmarks
1	0.00422189	0.00345428	0.19190417	0.10829171	0.1531848	0.05414586	0.00000694	0.45886896	0.00587951	0.00033584	0.00642326	0.00262962	0.01066011	3 (0.47256982) 22 (0.04859615) 26 (0.14103619) 30 (0.33779777)
2	0.00589887	0.00491573	0.51680682	0.00248617	0.00932314	0.00093231	0.00016485	0.02910283	0.08725973	0.00741586	0.12789765	0.02879815	0.17916274	2
3	0.00172517	0.00207021	0.25291047	0.09143421	0.07638193	0.01983946	0.00000759	0.11308492	0.42191916	0.01355696	0.00318235	0.00014171	0.00375344	7
4	0.06328491	0.02978113	0.70848386	0.17606103	0.00316425	0.00156351	0.00257812	0.01600736	0.00038098	0.00005162	0.00023715	0.00030068	0.00068352	3 (0.14319820) 7 (0.10762328) 15 (0.48980442) 24 (0.25937409)
5	0.00380514	0.00271795	0.24349571	0.05079905	0.06718544	0.01597703	0.00188241	0.29782814	0.07520377	0.00304572	0.09967314	0.01507667	0.12519225	2 (0.52468189) 3 (0.23129385) 22 (0.14189377) 30 (0.06574805) 32 (0.03638233)
6	0.41612231	0.2340688	0.08530507	0.03276963	0.04161223	0.02990879	0.00858252	0.15214472	0.00160901	0.00005548	0.00108625	0.00038751	0.00493018	0
7	0.01086013	0.00592371	0.90237788	0.00520819	0.05364436	0.0158329	0.00005218	0.00571638	0.00012947	0.00000066	0.00010952	0.00000161	0.00019519	4
8	0.00757171	0.00413002	0.24711291	0.13973237	0.24367122	0.28359476	0.00251751	0.07084056	0.00097818	0.00002638	0.00072358	0.00024372	0.0013746	0
9	0.10319104	0.24390609	0.05487888	0.03208304	0.03752401	0.01454056	0.00139589	0.10197151	0.09351628	0.00747711	0.07434308	0.03777862	0.19878978	22 (0.14865179) 24 (0.31853573) 32 (0.53281236)
10	0.01613876	0.00413846	0.07366667	0.02915489	0.04722391	0.0197699	0.00210879	0.14533063	0.46845296	0.00369904	0.10136773	0.0331974	0.05785092	3
11	0.2199696	0.13892817	0.05927602	0.03195348	0.03843679	0.01099848	0.00418521	0.0850935	0.09116294	0.00579102	0.07543261	0.07244583	0.17051154	0
12	0.07591729	0.05061153	0.14187529	0.1207555	0.11976163	0.01815951	0.00313625	0.29097948	0.05697678	0.00438379	0.0268835	0.01039745	0.08329825	3 (0.43847141) 22 (0.07907062) 24 (0.13859338) 30 (0.32284627) 32 (0.02101821)
13	0.00395285	0.00098821	0.17392535	0.04249313	0.06275148	0.03854028	0.00002463	0.13538507	0.53198758	0.0000857	0.00424767	0.00056493	0.00507776	0
14	0.04521775	0.02512097	0.78089247	0.00723484	0.01055081	0.00417008	0.00123897	0.02446782	0.0816599	0.00346669	0.00540716	0.00188075	0.00993076	3 (0.51233053) 7 (0.39520756) 15 (0.00201073) 24 (0.09045118)
15	0.00828409	0.00517755	0.81546462	0.16293977	0.00126332	0.00053847	0.00002247	0.00580922	0.0001938	0.00000266	0.00012613	0.00001893	0.00018146	2
16	0.05268678	0.01292099	0.51686694	0.1940355	0.05576915	0.00799153	0.00598575	0.08497879	0.01700563	0.00050049	0.02283897	0.00849583	0.02589251	0
17	0.26733555	0.00026734	0.04932341	0.020117	0.02539688	0.01136176	0.00081805	0.09196343	0.39659229	0.02281263	0.06298787	0.0081626	0.04367924	1
18	0.00251037	0.00338354	0.06778003	0.09070082	0.13970763	0.05610135	0.00000082	0.5997605	0.0148425	0.00097795	0.00660192	0.00039511	0.01723827	22 (1.00000000)
19	0.01115861	0.00418448	0.36544422	0.15429059	0.00608652	0.00599567	0.00060408	0.07058543	0.24243112	0.00003028	0.13823358	0.00000242	0.00155707	2 (0.00211832) 3 (0.08338457) 7 (0.21460394) 10 (0.05342005) 30 (0.64647303)
20	0.04770638	0.01458126	0.23113568	0.06001492	0.07749119	0.01967215	0.01796405	0.18433998	0.09325693	0.00315322	0.07933296	0.05669737	0.13261944	0
21	0.00696268	0.00107118	0.21155845	0.10497581	0.12800622	0.02731513	0.00551658	0.49542155	0.01016017	0.00009284	0.00311536	0.00200311	0.0093175	10 (0.71428541) 24 (0.14285765) 30 (0.14285652)
22	0.08560724	0.00581467	0.42077077	0.1058813	0.01404737	0.01176451	0.00006628	0.06379037	0.28938703	0.00006464	0.00117318	0.00003524	0.00166368	6
23	0.33316202	0.00057318	0.0934281	0.05720319	0.05777637	0.01226601	0.00288079	0.1936196	0.1392866	0.00325627	0.03641787	0.01129654	0.06171426	17 (0.00044482) 22 (0.00591524) 24 (0.46471905) 30 (0.49572142) 32 (0.03319941)
24	0.44943392	0.00287122	0.34562291	0.04455595	0.03990663	0.01851978	0.00037814	0.09407117	0.00164069	0	0.00150431	0.00010952	0.0017639	7
25	0.09711787	0.09711787	0.14722882	0.05499927	0.15941328	0.00832805	0.00021024	0.08782776	0.34483936	0.00001073	0.00092017	0.00001805	0.00217875	0
26	0.00249615	0.00231786	0.00249615	0.12694722	0.13853651	0.04065164	0.00000412	0.67217841	0.00635806	0.00000475	0.00364379	0.00019791	0.00417155	1
27	0.33455095	0.00055758	0.10259563	0.03457027	0.06635261	0.00892136	0.001801	0.17285133	0.07189902	0.0008627	0.07408734	0.01521305	0.11753816	0
28	0.00299638	0.00262183	0.16068078	0.11873148	0.18390271	0.09850593	0.00002009	0.40750742	0.00694411	0.00002872	0.00731366	0.00051563	0.01025136	3 (0.21839080) 7 (0.14942529) 10 (0.24137931) 24 (0.11494253) 30 (0.27586207)
29	0.31407225	0.31407225	0.07165502	0.0544392	0.03571118	0.02233403	0.00129002	0.15017309	0.01095517	0.00027025	0.0097112	0.00212625	0.0144801	0
30	0.14974722	0.00091244	0.11192622	0.11557599	0.0230558	0.0131863	0.00020636	0.15653675	0.41341342	0.01151442	0.00098021	0.00092843	0.00222279	7
31	0.00118482	0.00236964	0.87795066	0.11330791	0.00055686	0.00069904	0.00025515	0.00366109	0.00009005	0.00000016	0.00006122	0.00001927	0.00009929	0
32	0.00022822	0.00057056	0.01981692	0.00585759	0.03480323	0.00912872	0.00066354	0.03157014	0.19115783	0.0030429	0.2955041	0.01266609	0.3956537	4

Appendix 12.2 - Resource Efficiency DEA Model 1 under VRS (Cont)

DMU	{S} LI {I}	{S} TO {I}	{S} TA {I}	{S} OA {I}	{S} SRVCAR {I}	{S} WRAINQ {O}	{S} SUSPNOT {O}	{S} FINCOL {O}	{S} INFRNOT {O}	{S} IMPRNOT {O}	{S} OTHNOT {O}	{S} AREA {ON}	{S} INSPVIS {O}	{S} WRKCO-VINSP {O}	{S} WRIN-FSRV {O}	{S} PRINFSRV {O}	{S} PHINFSRV {O}	{S} COVIN-FAW {O}
1	0	0.00000071	203,018,538	252,683,261	0.00000001	0.00000048	0.00000048	0.00000049	0.00000047	0.00000047	0.00000047	0.02592407	0.00000047	0.00016648	0.00016584	0.00014702	0.00014481	0.00014724
2																		
3																		
4	0	0.28768386	0.29912529	0.3041438	0.88903153	0.00000005	0.00000005	0.00000021	0.00000029	0.00000503	0.00000504	0.00101047	0.00000504	0.01052991	0.00828104	0.00833787	0.00972504	0.01796639
5	0.00000001	0.00000003	0.00000001	337,577,158	0.00000001	0.0000362	0.00004761	0.00000145	0.00000504	0.00000098	0.00000061	0.00036756	0.00000079	0.00005992	0.0000663	0.00006731	0.00008625	0.00009574
6																		
7																		
8																		
9	0	284,241,510	225,014,195	386,302,414	0	0	0.00000001	0.00000912	0.00000054	0.00000022	0.00000022	0.00008857	0.00000022	0.00000307	0.00000306	0.00000306	0.00000306	0.00000307
10																		
11																		
12	0	156,391,236	0.43763537	173,477,186	0	0	0.00000001	0.00000007	0.00000006	0.00000005	0.00000003	0.00000584	0.00000004	0.00000104	0.00000004	0.00000147	0.0000015	0.00000196
13																		
14	0	0	0.34872046	150,145,257	0.29671345	0	0	0	0.00000051	0.00000003	0.00000003	0.00000621	0.00000003	0.00000008	0.00000009	0.00000201	0.00000178	0.00000284
15																		
16																		
17																		
18	0.00000004	0.00000003	0.40203755	159,796,252	0.00000003	0.00000082	0.00000075	0.00000078	0.00000079	0.00000008	0.00000082	687,344,675	0.00000008	0.00019241	0.00020736	0.00020332	0.00020803	0.00019694
19	0	0.00000001	0.00000001	0.00000001	0	0.00000075	0.00000076	0.00000075	0.00000046	0.00000913	0.00000967	0.00128438	0.00000892	0.00002928	0.00003058	0.00002417	0.01840513	0.00456839
20																		
21	0	0	0	0.85714193	0.42857125	0.00000002	0.00000018	0.00000018	0.00000018	0.00000018	0.00000018	0.00003338	0.00000018	0.00004275	0.000051	0.00004773	0.00004734	0.00005202
22																		
23	0	0.11443247	0.05233682	385,407,541	0	0.00000006	0.00000605	0.00000366	0.00000358	0.00000348	0.00000313	0.0005929	0.000003	0.00007886	0.00006663	0.00003721	0.00003797	0.00003734
24																		
25																		
26																		
27																		
28	0	0	0	0.66666667	0	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00044461	0.00000001	0.00000257	0.00000244	0.00000239	0.00000229	0.00000228
29																		
30																		
31																		
32																		

Appendix 12.3 - Cost Efficiency DEA Model 2 under CRS

DMU	Score	COSTS {O}{V}	WRAINQ {O}{V}	SUSPNOT {O}{V}	FINCOL {O}{V}	INFRNOT {O}{V}	IMPRNOT {O}{V}	OTHNOT {O}{V}	AREA {ON}{V}	INSPVIS {O}{V}	WRKCOVINS {O}{V}	WRINFSRV {O}{V}	PRINFSRV {O}{V}	PHINFSRV {O}{V}	COVINFAW {O}{V}	Benchmarks
1	192.24%	1	0.00319089	0.00261073	0.14504059	0.09166566	0.12966629	0.04583283	0.00000522	0.33671203	0.05561993	0.00317705	0.06076372	0.02487606	0.10084422	10 (0.27689497) 24 (0.09770110) 30 (1.18284417)
2	107.46%	1	0.00509767	0.00424806	0.44661224	0.00286334	0.01073753	0.00107375	0.00002555	0.03351795	0.1004977	0.0085409	0.14730071	0.03316705	0.20634311	7 (0.82347307) 10 (3.31010423)
3	101.45%	1	0.00178867	0.0021464	0.26221889	0.09479946	0.19281851	0.00994119	0.00000787	0.05666475	0.21141586	0.00679314	0.15946133	0.00007101	0.0018808	10 (0.81518621) 24 (0.51485582)
4	210.47%	1	0.01790364	0.00842524	0.81303601	0.10798084	0.00089518	0.00044233	0.00072936	0.00452857	0.01077729	0.00146038	0.0067086	0.00850598	0.01933593	7 (0.79400136) 24 (0.89729861)
5	198.01%	1	0.00631082	0.00450773	0.40389264	0.00831084	0.01099176	0.00261389	0.00004143	0.04872566	0.12163543	0.00492618	0.16121246	0.02438517	0.20248741	7 (0.54439539) 10 (4.51722040)
6	191.45%	1	0.28525071	0.16045352	0.0584764	0.02246349	0.02852507	0.0205024	0.0058833	0.10429479	0.06382104	0.00220073	0.04308608	0.01537069	0.19555509	10 (0.29421235) 24 (0.64504406)
7	100.00%	1	0.01164758	0.00635323	0.96780805	0.00052944	0.0054532	0.00160949	0.00005596	0.00613087	0.00013887	0.00000071	0.00011748	0.00000173	0.00020936	10
8	133.23%	1	0.00525104	0.0028642	0.17137483	0.09690555	0.168988	0.1966753	0.01214661	0.34179493	0.00471957	0.0001273	0.00349115	0.00117591	0.00663222	24 (0.77339505)
9	245.55%	1	0.01600319	0.03782572	0.03026685	0.01769447	0.02069528	0.00801942	0.00021648	0.05623943	0.18463641	0.01476264	0.14678129	0.07458925	0.39248604	10 (5.91951413) 32 (0.07731394)
10	100.00%	1	0.002091	0.00076036	0.05246253	0.02128914	0.0351651	0.01501645	0.00184284	0.11442913	0.45391488	0.00458912	0.20999544	0.08672841	0.00355844	22
11	140.76%	1	0.00853972	0.0053935	0.23012284	0.12405059	0.14922027	0.00499843	0.00190203	0.03867208	0.09635572	0.00612089	0.07972936	0.07657246	0.18022414	10 (1.53695746) 24 (0.33808030)
12	182.21%	1	0.00467113	0.00311408	0.14817851	0.12612041	0.12508238	0.01841844	0.00003823	0.29512835	0.08746222	0.00672934	0.04126752	0.01596061	0.12786701	10 (1.95900638) 24 (0.67061583) 30 (0.15639965)
13	151.12%	1	0.01245925	0.00311481	0.54820686	0.02149212	0.02155011	0.0132355	0.00007764	0.04649393	0.18269512	0.00294122	0.14587328	0.00019401	0.00174381	7 (0.33255413) 10 (0.38210816) 24 (0.12267183)
14	209.22%	1	0.00893574	0.0049643	0.57387312	0.04016932	0.0144582	0.00571443	0.00169779	0.03352924	0.11190184	0.00475055	0.06334065	0.02203153	0.11633107	7 (0.76683541) 10 (0.59737437) 24 (0.34090833)
15	125.33%	1	0.00663873	0.0041492	0.65349953	0.03523723	0.00905019	0.00385746	0.00001801	0.04161602	0.13883133	0.001904	0.09035349	0.01356291	0.00129991	7 (1.14483647) 10 (0.07604690) 24 (0.89266607)
16	139.92%	1	0.01684945	0.00561648	0.83123934	0.1404895	0.00131987	0.00025274	0.00029838	0.00381921	0.00007124	0.00000225	0.00011459	0.000047	0.00017834	7 (0.12801677) 24 (0.29303634)
17	142.87%	1	0.26180144	0.00027238	0.05025498	0.02049695	0.02587655	0.01157635	0.00080111	0.09370033	0.40408269	0.02324349	0.03599966	0.011446	0.06124918	10 (2.88541013) 24 (0.41282973) 30 (0.03134844)
18	196.85%	1	0.0017364	0.00234037	0.04688282	0.06273692	0.09663448	0.03880479	0.00000057	0.41484882	0.1245092	0.00820376	0.05538148	0.00331447	0.14460651	10 (10.05905847) 30 (1.15816851)
19	160.47%	1	0.00877532	0.00329075	0.28739179	0.2018324	0.00652886	0.00643141	0.00003647	0.07571527	0.26004994	0.00003248	0.14827896	0.0000026	0.00167022	10 (0.89665711) 24 (0.68908260)
20	230.81%	1	0.01296624	0.00555696	0.50568338	0.03903204	0.01323	0.00359651	0.00401396	0.03724953	0.06302448	0.00235485	0.07124507	0.05737283	0.18868811	7 (0.33182455) 10 (0.70849003) 24 (0.13420020)
21	132.55%	1	0.00641352	0.00098669	0.19487224	0.07985462	0.09737374	0.0207785	0.00419644	0.37686489	0.09171107	0.00083799	0.02812086	0.01808115	0.08410474	10 (0.09740688) 24 (0.18051543) 30 (0.42063772)
22	131.28%	1	0.00200996	0.00066999	0.04848275	0.03709296	0.03298167	0.02762177	0.00000156	0.14977271	0.67944875	0.01517624	0.00275436	0.00008273	0.00390613	10 (11.59083378)
23	129.74%	1	0.04919181	0.00099611	0.16236542	0.09941147	0.10040757	0.02131669	0.00500643	0.33648491	0.09506386	0.00222243	0.04410922	0.01368234	0.07474817	10 (0.30694056) 24 (0.57165874) 30 (0.59623944)
24	100.00%	1	0.42075145	0.05803425	0.33203821	0.0417125	0.03735988	0.01733788	0.00035401	0.08806764	0.001536	0	0.00140832	0.00010253	0.00165133	22
25	128.01%	1	0.00465272	0.00465272	0.20239311	0.07560662	0.21914289	0.00875879	0.00000957	0.09237027	0.36267467	0.00031624	0.02712155	0.00001899	0.00229143	10 (0.31887249) 24 (0.03890512) 30 (1.37677227)
26	119.82%	1	0.0023727	0.00220323	0.0023727	0.12066896	0.13168509	0.03864118	0.00000392	0.63893536	0.05549929	0.00000452	0.00346359	0.00018812	0.00396524	24 (1.70338810) 30 (0.13032466)
27	178.57%	1	0.01361118	0.00226853	0.41740933	0.02842301	0.05455384	0.00733497	0.00007331	0.14211502	0.08596093	0.00103143	0.08857724	0.0181884	0.14052612	7 (0.10941671) 10 (0.90776266) 24 (0.30717684)
28	124.12%	1	0.00249555	0.0021836	0.1338236	0.09888597	0.15316408	0.08204104	0.00001675	0.29421366	0.06463431	0.00026728	0.06807403	0.00479935	0.09541753	10 (0.39128732) 24 (0.42589424) 30 (0.30894230)
29	134.47%	1	0.22654777	0.22654777	0.0516865	0.03926831	0.02575934	0.01611007	0.00093052	0.10832347	0.0892202	0.00220097	0.07908927	0.01731646	0.11792992	10 (0.31638803) 24 (1.01500164)
30	100.00%	1	0.01274677	0.00186538	0.22882007	0.23628159	0.01929057	0.01103285	0.00001757	0.13097284	0.34589917	0.00963401	0.00082013	0.00077681	0.00185979	9
31	138.94%	1	0.00124377	0.00248754	0.92163201	0.06919164	0.00058457	0.00073382	0.00026785	0.00384324	0.00009453	0.00000017	0.00006426	0.00002023	0.00010423	7 (0.80634221) 24 (0.26576386)
32	100.00%	1	0.00022822	0.00057054	0.01981692	0.00585759	0.03480323	0.00912871	0.00000664	0.03157014	0.19115783	0.0030429	0.29550411	0.01266609	0.39565372	1

Appendix 12.3 - Cost Efficiency DEA Model 2 under CRS (Cont)

DMU	{S} COSTS {I}	{S} WRINQ {O}	{S} SUSPNOT {O}	{S} FINCOL {O}	{S} INFRNOT {O}	{S} IMPRNOT {O}	{S} OTHNOT {O}	{S} AREA {ON}	{S} INSPVIS {O}	{S} WRKCO-VINSP {O}	{S} WRINFSRV {O}	{S} PRINFSRV {O}	{S} PHINFSRV {O}	{S} COVINFAW {O}
1	0.00003858	0.00000036	0.00000036	0.00000038	0.00000038	0.00000038	0.00000038	0.11610464	0.00000046	0.00000925	0.00001004	0.00000099	0.00000983	0.00000983
2	0.00000608	0.00000003	0.00000003	0.00000003	0.00000034	0.00000034	0.00000034	0.00076198	0.00000034	0.00000103	0.00000103	0.00000103	0.00000103	0.00000103
3	0.00007719	0.00000058	0.00000058	0.00000058	0.00000058	0.00000058	0.00000291	0.13516108	0.00000295	0.00000886	0.00000887	0.00000888	0.00108613	0.00071265
4	0.00000268	0.00000001	0.00000001	0.00000001	0.00000005	0.00000251	0.00000123	0.00034135	0.00000231	0.00001656	0.0000067	0.00002249	0.00002217	0.00004065
5	0.00008361	0.00000035	0.00000035	0.00000035	0.00000604	0.00000506	0.00000478	0.00691212	0.00000446	0.00001431	0.00001431	0.00001435	0.00001443	0.00001448
6	0.00000097	0	0	0.00000025	0.00000021	0.00000019	0.00000002	0.00003152	0.00000014	0.00000031	0.00000071	0.00000047	0.00000035	0.00000036
7														
8	0.00000027	0	0	0	0	0	0	0.00000051	0	0.00000002	0.00000005	0.00000168	0.00000191	0.00000429
9	0.00006424	0.0000001	0.0000001	0.00000228	0.00000233	0.00000233	0.00000242	0.00055396	0.00000253	0.00000774	0.00000775	0.00000775	0.00000775	0.00000777
10														
11	0.00002004	0.00000011	0.0000001	0.00000011	0.00000011	0.0000003	0.00000234	0.00024385	0.00000226	0.00000345	0.00000348	0.0000035	0.00000351	0.00000354
12	0.00065909	0.00000628	0.00000614	0.00000606	0.00000606	0.00000607	0.00000847	121,263,523	0.00000851	0.00013237	0.00013317	0.00013342	0.00013469	0.00013431
13	0.00000062	0	0	0	0.00000001	0.00000002	0.00000002	0.00135378	0.00000002	0.00000007	0.00000007	0.00000007	0.00000614	0.00001655
14	0.00007572	0.00000033	0.00000032	0.00000032	0.00000128	0.00001534	0.00001439	0.00026925	0.00000532	0.00003147	0.0000262	0.00003156	0.00003251	0.00009422
15	0.00000007	0	0	0	0.00000001	0.00000003	0.00000003	0.00012658	0.00000003	0.00000001	0.00000001	0.00000001	0.00000001	0.00062175
16	0.00007226	0.00000022	0.00000022	0.00000022	0.00000054	0.00002128	0.00002129	0.00426565	0.00002129	0.01885885	0.01989003	0.01431247	0.0099844	0.01120709
17	0.00000013	0	0	0	0	0	0	0.00000082	0	0.00000001	0.00000001	0.00000006	0.00000006	0.00000006
18	0.00181728	0.00000346	0.00013536	0.00003049	0.00002942	0.0000293	0.00003103	0.60916556	0.00002425	0.00133598	0.00054474	0.00061905	0.00068718	0.00077257
19	0.00000618	0.00000004	0.00000004	0.00000004	0.00000004	0.00000022	0.00000022	0.00074931	0.00000022	0.00000065	0.00000064	0.00000064	0.00006527	0.00006532
20	0.00001015	0.00000007	0.00000006	0.00000005	0.00000025	0.0000012	0.00000098	0.00006263	0.0000006	0.00000245	0.00000198	0.00000218	0.00000219	0.00000246
21	0.00000013	0.00000001	0.00000001	0.00000002	0	0	0	0.00000046	0	0.00000014	0.00000048	0.00000009	0.00000008	0.00000007
22	0.00000505	0.00000009	0.00000005	0.0000001	0.0000001	0.0000001	0.0000001	0.10329248	0.0000001	0.0000003	0.00000032	0.0001959	0.00005099	0.00002317
23	0.00000327	0.00000001	0.00000027	0.00000004	0.00000003	0.00000003	0.00000004	0.00000669	0.00000004	0.00000111	0.00000096	0.00000117	0.00000135	0.00000163
24														
25	0.00000184	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000006	0.00014373	0.00000006	0.00000017	0.00000065	0.00000069	0.00000923	0.00001071
26	0.00041074	0.00000364	0.00000364	0.00000365	0.00000365	0.00000365	0.00000365	493,010,789	0.00000365	0.00011752	0.00547547	0.00105644	0.0010524	0.00107969
27	0.0001466	0.00000067	0.00000067	0.00000067	0.00000333	0.00000333	0.00000333	0.05242399	0.00000333	0.00003036	0.00003036	0.00003036	0.00003036	0.00003036
28	0.00000746	0.00000007	0.00000007	0.00000007	0.00000007	0.00000007	0.00000007	0.0924752	0.00000009	0.00000146	0.00000147	0.00000147	0.00000147	0.00000148
29	0.0000318	0.00000001	0.00000001	0.00000172	0.00000163	0.00000154	0.00000162	0.00037945	0.00000075	0.00000667	0.00000641	0.00000577	0.00000592	0.00000655
30														
31	0.00000176	0.00000001	0.00000001	0.00000001	0.00000001	0.00000052	0.00000052	0.00010419	0.00000052	0.00023966	0.0001444	0.000146	0.00013472	0.00012799
32														

Appendix 12.4 - Cost Efficiency DEA Model 2 under CRS (assuming that Viana do Castelo branch becomes cost efficient)

DMU	Score	COSTS {I}{V}	WRAINQ {O}{V}	SUSPNOT {O}{V}	FINCOL {O}{V}	INFRNOT {O}{V}	IMPRNOT {O}{V}	OTHNOT {O}{V}	AREA {ON}{V}	INSPVIS {O}{V}	WRKCO- VINSP {O}{V}	WRINFSRV {O}{V}	PRINFSRV {O}{V}	PHINFSRV {O}{V}	COVINFAW {O}{V}	Benchmarks		
1	192.24%	1	0.00319081	0.00261066	0.14503671	0.0916632	0.12966282	0.0458316	0.00000522	0.33672207	0.05562019	0.00317706	0.06076401	0.02487618	0.1008447 (1.18284896)	10 (0.24644705) (1.18284896)	29 (0.09622927)	30
2	107.46%	1	0.00509767	0.00424806	0.44661224	0.00286334	0.01073753	0.00107375	0.00002555	0.03351795	0.1004977	0.0085409	0.14730071	0.03316705	0.20634311	7 (0.82347306)	10 (3.31010424)	
3	101.45%	1	0.00178864	0.00214637	0.26221451	0.09479787	0.19281529	0.00994139	0.00000787	0.05666593	0.21142024	0.00679328	0.15946463	0.00007101	0.00188083	10 (0.65478591)	29 (0.50703357)	
4	210.47%	1	0.01790364	0.00842524	0.81303602	0.10798084	0.00089518	0.00044233	0.00072936	0.00452857	0.01077729	0.00146038	0.0067086	0.00850598	0.01933593	7 (0.79400136)	24 (0.89729861)	
5	198.01%	1	0.00631082	0.00450773	0.40389264	0.00831084	0.01099176	0.00261389	0.00004143	0.04872566	0.12163543	0.00492618	0.16121246	0.02438517	0.20248741	7 (0.54439538)	10 (4.51722039)	
6	191.49%	1	0.28518106	0.16041434	0.05846212	0.02245801	0.02851811	0.02049739	0.00588186	0.10426932	0.06385415	0.00220187	0.04310843	0.01537867	0.19565654	10 (0.09354401)	29 (0.63535517)	
7	100.00%	1	0.01164758	0.00635323	0.96780805	0.00052944	0.00545319	0.00160949	0.00005596	0.00613087	0.00013888	0.00000071	0.00011748	0.00000173	0.00020936			10
8	133.23%	1	0.00525104	0.0028642	0.17137483	0.09690555	0.168988	0.19667529	0.01214661	0.34179493	0.00471957	0.0001273	0.00349115	0.00117592	0.00663223	24 (0.77339505)		
9	245.55%	1	0.01600319	0.03782572	0.03026685	0.01769447	0.02069528	0.00801942	0.00021648	0.05623943	0.18463641	0.01476264	0.14678129	0.07458925	0.39248604	10 (5.91951422)	32 (0.07731392)	
10	100.00%	1	0.0020909	0.00076033	0.05246254	0.02128915	0.03516511	0.01501645	0.00184284	0.11442916	0.45391501	0.00458911	0.20999549	0.08672843	0.00355833			20
11	140.76%	1	0.00853792	0.00539237	0.23007434	0.12402445	0.14918883	0.00499956	0.00190246	0.03868081	0.09637749	0.00612227	0.07974737	0.07658976	0.18026485	10 (1.43138019)	29 (0.33315857)	
12	182.21%	1	0.00467097	0.00311398	0.14817366	0.12611629	0.12507829	0.01841918	0.00003821	0.29514026	0.08746243	0.00672935	0.04126762	0.01596065	0.12786731	10 (1.75010797) (0.15641869)	29 (0.66025828)	30
13	151.12%	1	0.01245925	0.00311481	0.54820681	0.02148346	0.02155056	0.01323578	0.00007766	0.0464949	0.18269894	0.00294128	0.14587634	0.00019401	0.00174385	7 (0.33255049)	10 (0.34388254)	29 (0.12083815)
14	209.22%	1	0.0089358	0.00496434	0.57387715	0.04010801	0.01446042	0.00571531	0.00169807	0.03353439	0.11191903	0.00475128	0.06335039	0.02203492	0.11634895	7 (0.76688513)	10 (0.49092213)	29 (0.33582933)
15	125.33%	1	0.00663944	0.00414965	0.65357026	0.03525897	0.00904737	0.00385625	0.00001801	0.04160305	0.13878807	0.00190341	0.09032534	0.01355869	0.00129951	7 (1.14482963)	24 (0.64868578)	29 (0.24037571)
16	139.92%	1	0.01684945	0.00561648	0.83123935	0.1404895	0.00131987	0.00025274	0.00029838	0.00381921	0.00007124	0.00000225	0.00011459	0.00004699	0.00017833	7 (0.12801677)	24 (0.29303634)	
17	142.88%	1	0.26160275	0.00027254	0.05028334	0.02050852	0.02589115	0.01158288	0.0008005	0.09375322	0.40431077	0.02325661	0.03594778	0.01142951	0.06116092	10 (2.75725693) (0.03145002)	29 (0.40641952)	30
18	196.85%	1	0.0017364	0.00234037	0.04688282	0.06273692	0.09663448	0.03880478	0.00000057	0.41484879	0.1245092	0.00820376	0.05538149	0.00331447	0.14460653	10 (10.05905916)	30 (1.15816835)	
19	160.47%	1	0.00877513	0.00329067	0.28738559	0.20182805	0.00652899	0.00643154	0.00003647	0.07571679	0.26005517	0.00003248	0.14828273	0.0000026	0.00167025	10 (0.68189941)	29 (0.67888327)	
20	230.81%	1	0.01296619	0.00555694	0.50568125	0.03897204	0.01323189	0.00359702	0.00401453	0.03725483	0.06303346	0.00235519	0.07125521	0.057381	0.18871498	7 (0.33184138)	10 (0.66658156)	29 (0.13223553)
21	132.57%	1	0.00637706	0.00098109	0.1937643	0.07997838	0.09752466	0.0208107	0.00420294	0.37744897	0.09181768	0.00083896	0.02815355	0.01810217	0.0842025	10 (0.04189983) (0.42007126)	29 (0.17812246)	30
22	131.28%	1	0.00200996	0.00066999	0.04848275	0.03709296	0.03298167	0.02762177	0.00000156	0.14977271	0.67944875	0.01517624	0.00275436	0.00008273	0.00390613	10 (11.59083379)		
23	129.78%	1	0.04765481	0.00099851	0.16275792	0.09965178	0.1006503	0.02136822	0.00501854	0.33729832	0.0949787	0.00222044	0.04406971	0.01367009	0.07468121	10 (0.13153330) (0.59381757)	29 (0.56456876)	30
24	100.00%	1	0.03570714	0.00492512	0.59286063	0.35399259	0.00317055	0.00147138	0.00003004	0.00747387	0.00013035	0	0.00011952	0.0000087	0.00014014			6
25	128.01%	1	0.00465263	0.00465263	0.20238927	0.07560519	0.21913873	0.00875901	0.00000957	0.09237265	0.36268401	0.00031621	0.02711919	0.00001899	0.00229149	10 (0.30675088) (1.37677231)	29 (0.03831718)	30
26	119.82%	1	0.0023727	0.00220323	0.0023727	0.12066895	0.13168508	0.03864118	0.00000392	0.63893532	0.05549937	0.00000452	0.00346358	0.00018812	0.00396524	24 (1.70338825)	30 (0.13032460)	
27	178.58%	1	0.01361161	0.0022686	0.41742286	0.02841852	0.05454521	0.00733381	0.00007328	0.14209258	0.08596676	0.0010315	0.08858325	0.01818963	0.14053566	7 (0.10939628)	10 (0.81202110)	29 (0.30264651)
28	124.12%	1	0.00249549	0.00218355	0.13382039	0.0988836	0.1531604	0.08203907	0.00001674	0.29422325	0.06463479	0.00026728	0.06807455	0.00479938	0.09541825	10 (0.25855083) (0.30895062)	29 (0.41954073)	30
29	100.00%	1	0.01432274	0.00215598	0.24457791	0.1174324	0.11026123	0.05075839	0.00210371	0.26987369	0.06538173	0.00018754	0.05293561	0.0067733	0.06533949			16
30	100.00%	1	0.01274649	0.00186534	0.22881498	0.23627634	0.01929097	0.01103308	0.00001757	0.13097553	0.34590625	0.0096342	0.00082015	0.00077683	0.00185983			9
31	138.94%	1	0.00124377	0.00248754	0.92163201	0.06919164	0.00058457	0.00073382	0.00026785	0.00384324	0.00009453	0.00000017	0.00006426	0.00002023	0.00010423	7 (0.80634221)	24 (0.26576386)	
32	100.00%	1	0.00022822	0.00057054	0.01981692	0.00585759	0.03480323	0.00912871	0.00000664	0.03157014	0.19115783	0.0030429	0.29550411	0.01266609	0.39565372			1

Appendix 12.5 - Cost Efficiency DEA Model 2 under VRS

DMU	Score	COSTS {O}{V}	WRAINQ {O}{V}	SUSPNOT {O}{V}	FINCOL {O}{V}	INFRNOT {O}{V}	IMPRNOT {O}{V}	OTHNOT {O}{V}	AREA {ON}{V}	INSPVIS {O}{V}	WRKCO- VINSF {O}{V}	WRINFSRV {O}{V}	PRINFSRV {O}{V}	PHINFSRV {O}{V}	COVINFAW {O}{V}	Benchmarks				
1	164.91%	1	0.00449955	0.00368145	0.20452495	0.12925977	0.1828453	0.0430394	0.00000736	0.36474534	0.01528459	0.00087307	0.01669813	0.00683605	0.02771242	22 (0.10400631 0.47370853)	24 (0.32193956)	26 (0.10034560)	30	
2	100.00%	1	0.00548662	0.00457219	0.48068921	0.00268024	0.0100509	0.00100509	0.00017776	0.03137456	0.09407113	0.00799473	0.13788122	0.0310461	0.19314801				7	
3	100.00%	1	0.0023508	0.00282096	0.34462683	0.02430864	0.04944286	0.0128423	0.00001034	0.07320112	0.27311294	0.00877557	0.20599662	0.00009173	0.00242964				1	
4	175.40%	1	0.03811056	0.01793438	0.92455374	0.00591841	0.00190553	0.00094156	0.00155256	0.00963973	0.00022945	0.00003109	0.00014282	0.00018109	0.00041165	7 (0.04851629)	15 (0.64287292)	24 (0.30861074)		
5	160.35%	1	0.00551439	0.00393885	0.35292088	0.04172672	0.05518694	0.01312372	0.00154624	0.24463967	0.06687424	0.00270838	0.08863339	0.01340678	0.11132603	2 (0.65938489) 0.17145999)	22 (0.16178729)	24 (0.00736774)	30	
6	186.43%	1	0.41612214	0.2340687	0.08530509	0.03276964	0.04161224	0.02990879	0.00858252	0.15214473	0.00160905	0.00005548	0.00108628	0.00038752	0.00493031	10 (0.40455218)	24 (0.59544779)			
7	100.00%	1	0.01164758	0.00635323	0.96780813	0.00052944	0.00545319	0.00160948	0.00005596	0.00613086	0.00013885	0.00000071	0.00011746	0.00000173	0.00020934				5	
8	124.26%	1	0.00764688	0.00417102	0.24956617	0.14111959	0.24609031	0.2864102	0.00220561	0.06206397	0.000857	0.00002312	0.00063393	0.00021353	0.0012043	7 (0.19571306)	10 (0.32395253)	24 (0.48033440)		
9	175.53%	1	0.06413486	0.15159149	0.09536672	0.01994013	0.02332177	0.00903719	0.00086757	0.06337691	0.13014273	0.01040558	0.10346019	0.05257494	0.2766475	2 (0.01572727) 0.39690148)	22 (0.36506563)	24 (0.22230554)	32	
10	100.00%	1	0.00261368	0.00095043	0.06557947	0.02661196	0.04395725	0.01877094	0.00002307	0.14303928	0.56740497	0.0026827	0.1227588	0.00118251	0.00444803				8	
11	133.20%	1	0.01047227	0.00661407	0.28219955	0.0916749	0.02127163	0.00608676	0.00231617	0.04709231	0.11733567	0.00745361	0.09708918	0.09324491	0.21946512	10 (0.22988942) 0.25821998)	24 (0.46988579)	30 (0.04200481)	32	
12	149.17%	1	0.00617727	0.00411818	0.19595683	0.16678638	0.16541365	0.00940744	0.00162472	0.15074032	0.09438727	0.00726215	0.04453498	0.01722433	0.1379912	22 (0.15814333) 0.09207256)	24 (0.65993786)	30 (0.08984625)	32	
13	140.17%	1	0.01605563	0.00401391	0.70644778	0.09307915	0.00937416	0.00575735	0.00010005	0.02022455	0.07947118	0.00127941	0.06345392	0.00008439	0.00075856	7 (0.27710319) 0.04837312)	10 (0.41850709)	16 (0.25601660)	24	
14	192.90%	1	0.01015514	0.00564175	0.65218596	0.01688447	0.02462319	0.00973202	0.00289147	0.05710234	0.19057565	0.00809048	0.00785355	0.00273167	0.01442378	2 (0.07311898) 0.01747476)	15 (0.13072403)	24 (0.77868223)	30	
15	100.00%	1	0.00833367	0.00520854	0.82034551	0.15792951	0.00127089	0.00054169	0.00002261	0.00584399	0.00019504	0.00000267	0.00012689	0.00001905	0.00018255				3	
16	100.00%	1	0.01562795	0.00498399	0.69081427	0.27152124	0.00423846	0.00069513	0.00044491	0.00612921	0.00151257	0.00004382	0.00197214	0.00069948	0.00176026				1	
17	115.45%	1	0.18681245	0.00070981	0.13096083	0.01405764	0.01774718	0.00793953	0.00057165	0.06426348	0.27713495	0.01594125	0.09420397	0.02995192	0.16027697	2 (0.05604298) 0.15838070)	22 (0.11421614)	30 (0.67135106)	32	
18	111.94%	1	0.00251037	0.00338354	0.06778003	0.09070082	0.13970764	0.05610135	0.00000082	0.59976053	0.01484248	0.00097795	0.00660191	0.00039511	0.01723825	22 (1.00000000)				
19	155.79%	1	0.01039424	0.00389784	0.34041121	0.05070974	0.00778402	0.00766784	0.00077259	0.09027142	0.31004418	0.00003873	0.17678637	0.00000031	0.00199132	2 (0.03438255) 0.50634728)	3 (0.25893409)	24 (0.20033602)	30	
20	227.81%	1	0.01207707	0.00517589	0.47100564	0.02485818	0.01474825	0.00400923	0.00447459	0.0415242	0.07025704	0.00262509	0.07942101	0.06395682	0.21034157	2 (0.05161140) 0.15956668)	7 (0.26228500)	10 (0.52653691)	24	
21	129.63%	1	0.00632216	0.00097264	0.19209626	0.09531865	0.1162304	0.0248023	0.00500909	0.44984567	0.1012197	0.0000843	0.00282876	0.00181884	0.00846034	10 (0.53702698)	24 (0.39733670)	30 (0.06563632)		
22	100.00%	1	0.08560727	0.00581467	0.42077079	0.10588117	0.01404737	0.01176451	0.00006628	0.06379038	0.28938715	0.00006464	0.00117312	0.00003524	0.00166368				9	
23	114.55%	1	0.12227109	0.00112153	0.18280979	0.11192727	0.11304878	0.02400044	0.00563674	0.37884799	0.02728932	0.00063797	0.01266165	0.00392755	0.02145663	22 (0.08101134) 0.17702484)	24 (0.70107205)	26 (0.04089177)	30	
24	100.00%	1	0.46139211	0.00272842	0.32843095	0.04574146	0.04096844	0.01901254	0.00038821	0.09657414	0.00168435	0	0.00154434	0.00011243	0.00181083				19	
25	106.86%	1	0.00593726	0.00593726	0.25827067	0.09648042	0.27964479	0.00663303	0.00001222	0.06995199	0.27465347	0.00000855	0.00073289	0.00001438	0.0017353	22 (0.17208093)	24 (0.43951287)	30 (0.38840621)		
26	100.00%	1	0.00249615	0.00231786	0.00249615	0.12694722	0.13853651	0.04065164	0.00000412	0.67217841	0.00635806	0.00000475	0.00364379	0.00019791	0.00417155				2	
27	173.34%	1	0.01134879	0.00189146	0.34802953	0.02563258	0.04919802	0.00661486	0.00006109	0.1281629	0.11034839	0.00132405	0.11370696	0.02334852	0.18039394	2 (0.02844753) 0.05551859)	10 (0.48283362)	24 (0.43320026)	32	
28	123.05%	1	0.00253487	0.00221801	0.13593259	0.10044436	0.15557786	0.08333396	0.000017	0.16701678	0.09782533	0.00040453	0.10303143	0.00726391	0.14441636	10 (0.20565469) 0.02628534)	24 (0.40642933)	30 (0.36163063)	32	
29	125.80%	1	0.23056367	0.23056367	0.05260268	0.03996437	0.02621594	0.01639564	0.00094702	0.11024359	0.08562919	0.00211238	0.07590601	0.01661949	0.11318337	22 (0.03723541)	24 (0.96197209)	32 (0.00079250)		
30	100.00%	1	0.00883939	0.00129357	0.15867784	0.16385212	0.02474276	0.01415112	0.00001227	0.16799031	0.44366225	0.01235691	0.00105193	0.00099637	0.00238543				11	
31	134.97%	1	0.00130514	0.00261029	0.96711139	0.02325943	0.00061342	0.00077003	0.00028106	0.00403289	0.00009919	0.00000017	0.00006743	0.00002123	0.00010937	7 (0.72378991)	15 (0.06555701)	24 (0.21065308)		
32	100.00%	1	0.00022822	0.00057055	0.01981692	0.00585759	0.03480323	0.00912872	0.00066354	0.03157014	0.19115783	0.00304291	0.29550411	0.01266609	0.3956537				7	

Appendix 12.5 - Cost Efficiency DEA Model 2 under VRS (Cont)

DMU	{S} COSTS {I}	{S} WRAINQ {O}	{S} SUSPNOT {O}	{S} FINCOL {O}	{S} INFRNOT {O}	{S} IMPRNOT {O}	{S} OTHNOT {O}	{S} AREA {ON}	{S} INSPVIS {O}	{S} WRKCOVINS {O}	{S} WRINFSRV {O}	{S} PRINFSRV {O}	{S} PHINFSRV {O}	{S} COVINFAW {O}
1	0.00000014	0	0	0	0	0	0	0.00159002	0	0.00000006	0.00000006	0.00000006	0.00000006	0.00000006
2														
3														
4	0.00060825	0.00000051	0.00000051	0.00000095	0.0000511	0.00005036	0.00005045	0.01013187	0.00005059	0.10311886	0.12072897	0.11583835	0.11313153	0.10290458
5	0.00056619	0.00001991	0.00002377	0.00000262	0.000005	0.00000447	0.00000482	0.00099858	0.00000498	0.00010631	0.00009046	0.00010134	0.00009661	0.00006078
6	0.00016974	0.00000005	0.00000005	0.00000525	0.00000526	0.00000527	0.00000527	0.00105572	0.00000527	0.00161111	0.00204776	0.00094166	0.0023775	0.0006704
7														
8	0.00002757	0.00000024	0.00000024	0.00000021	0.00000021	0.00000021	0.00000021	0.00027528	0.00000221	0.00241694	0.0001001	0.0003552	0.0004564	0.00044732
9	0.00061547	0.00000012	0.00000012	0.00001197	0.0000438	0.00001203	0.00001204	0.00241061	0.00001207	0.00005638	0.00005608	0.00005592	0.000056	0.00005604
10														
11	0.00001268	0.00000008	0.00000007	0.00000011	0.00000012	0.00000072	0.00000064	0.00009555	0.00000042	0.00000168	0.00000166	0.00000166	0.00000166	0.00000168
12	0.00000161	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000003	0.00000636	0.00000003	0.00000027	0.00000031	0.00000029	0.0000003	0.00000029
13	0.00000154	0.00000004	0.00000001	0.00000001	0.00000001	0.00000002	0.00000023	0.00095478	0.0000002	0.00000075	0.00000079	0.00000085	0.018895	0.0219569
14	0.00000064	0	0	0	0.00000005	0.00000005	0.00000005	0.00001069	0.00000005	0.00000019	0.00000023	0.00000314	0.00000344	0.00000299
15														
16														
17	0.000082	0.00000002	0.00000054	0.00000051	0.00000196	0.00000195	0.00000195	0.00038831	0.00000194	0.00000575	0.00000575	0.00000829	0.00000819	0.00000823
18	28,512,303,301,533	0.00000085	0.00000067	0.00000025	0.00000024	0.00000024	0.00000028	0.01646477	0.00000032	0.00000801	0.00059105	0.00040118	0.00039928	0.00044383
19	0.00002515	0.00000017	0.00000013	0.00000012	0.00000087	0.00000061	0.00000006	0.00012902	0.00000065	0.00000201	0.00000195	0.00000246	0.00021347	0.00023517
20	0.00001624	0.00000035	0.00000032	0.00000007	0.00000064	0.00000071	0.00000066	0.00013697	0.00000071	0.00000291	0.00000279	0.00000282	0.00000285	0.00000287
21	0.00000019	0	0	0	0	0	0	0.00000037	0	0.00000006	0.00004875	0.00000054	0.00000054	0.00000054
22														
23	0.00015241	0.00000003	0.00000459	0.00000014	0.00000076	0.00000076	0.00000076	0.00014985	0.00000076	0.00021203	0.00013245	0.00015681	0.00018118	0.00018225
24														
25	0.00000198	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000004	0.00029715	0.00000004	0.00000013	0.00065096	0.00002347	0.00001139	0.00000767
26														
27	0.00000101	0	0	0	0.00000002	0.00000002	0.00000002	0.00008435	0.00000002	0.00000014	0.00000014	0.00000014	0.00000014	0.00000014
28	0.00000039	0.00000001	0	0	0	0	0	0.0098765	0.00000001	0.00000006	0.00000006	0.00000006	0.00000006	0.00000006
29	0.00000022	0	0	0.00000003	0.00000024	0.00000023	0.00000026	0.00005495	0.00000025	0.00000074	0.00000078	0.00000081	0.00000085	0.00000097
30														
31	0.00000422	0.00000001	0.00000001	0.00000001	0.00000006	0.00000069	0.00000069	0.00013746	0.00000069	0.00379918	0.0020917	0.00119674	0.00075606	0.00067207
32														

Appendix 12.6 - Effectiveness DEA Model 3 (CRS/VRS)

DMU	Score	UNINPUT {I}{V}	FWRA {O}{V}	PNFWRA {O}{V}	PDAYSABS {O}{V}	Benchmarks	{S} UN- INPUT {I}	{S} FWRA {O}	{S} NFWRA {O}	{S} DAYSABS {O}
1	119.63%	1	0.23470487	0.4386679	0.32662723	8 (0.90712154) 26 (0.09287846)	0	0	0.00000005	0.00003797
2	156.27%	1	0.18274759	0.19188179	0.62537062	8 (0.99999643)	0	0.00000002	0.0000037	0.00063495
3	109.07%	1	0.39729584	0.60230536	0.00039879	26 (0.99999996)	0	0.00000014	0.00002781	6,521,513,750
4	117.37%	1	0.23288269	0.45501737	0.31209994	8 (0.63906448) 26 (0.36093218)	0	0.00000032	0.00006037	0.02373855
5	112.79%	1	0.61444262	0.11760724	0.26795014	10 (0.92715865) 28 (0.07283793)	0	0.00000068	0.00006695	0.00772487
6	165.15%	1	0.35480211	0.64519789	0	26 (1.00000000)	0	0	0.00000013	0.20265094
7	163.07%	1	0.09681368	0.18585928	0.71732704	8 (0.99999999)	0	0	0.00000134	0.00007185
8	100.00%	1	0.23539028	0.39350155	0.37110817	14	0	0.00000001	0.00000202	0.00026871
9	114.43%	1	0.18637916	0.31338952	0.50023132					
10	100.00%	1	0.5993031	0.19398276	0.20671414	7	0	0.00000002	0.00001004	102,313,663
11	106.34%	1	0.65510333	0.34451839	0.00037828					
12	111.49%	1	0.63838996	0.15119361	0.21041643	10 (0.47392223) 28 (0.52607702)	0	0.00000007	0.00016998	0.02948049
13	135.37%	1	0.05628179	0.42742144	0.51629676	8 (0.99999977)	0	0	0.00000008	0.00000473
14	116.17%	1	0.12812898	0.43234566	0.43952535	8 (0.99999831)	0	0.00000069	0.00009903	0.00062077
15	106.12%	1	0.99839168	0.00034789	0.00126042	28 (1.00000000)	0	0	0.00475347	0.47159402
16	108.66%	1	0.21848276	0.32658916	0.45492807	8 (0.99999990)	0	0.00000004	0.00000534	0.00021347
17	133.57%	1	0.29822167	0.00000883	0.7017695	8 (0.47961856) 26 (0.52038105)	0	0.00000004	0.00000865	0.00039967
18	112.06%	1	0.99830621	0.00076299	0.0009308	28 (1.00000000)	0	0	0.00311024	0.06690724
19	165.41%	1	0.17621209	0.29805351	0.5257344	8 (0.99999783)	0	0.00000001	0.00000266	0.00038066
20	178.25%	1	0.13366022	0.57945195	0.28688783	8 (0.17387965) 26 (0.82612025)	0	0.00000019	0.00004052	0.00371981
21	124.24%	1	0.18373425	0.42211878	0.39414696	8 (0.99999998)	0	0	0.00000011	0.00000413
22	111.07%	1	0.64528914	0.11796103	0.23674982	10 (0.34334114) 28 (0.65665840)	0	0.00000021	0.00019602	0.00847848
23	160.81%	1	0.00233202	0.44280161	0.55486637	8 (1.00000000)	0	0.00000001	0.00000129	0.00005748
24	104.61%	1	0.99814499	0.00052318	0.00133183	28 (0.99999999)	0	0	0.01506651	100,038,391
25	153.98%	1	0.99851601	0.00088762	0.00059637	28 (0.99999991)	0	0.00000012	0.02723264	101,252,921
26	100.00%	1	0.39622046	0.54551478	0.05826476	8	0	0.00000007	0.00010517	0.00725907
27	118.47%	1	0.62187111	0.0845497	0.29357921					
28	100.00%	1	0.94314423	0.05602059	0.00083518	12	0	0.00000005	0.00019104	0.0088391
29	120.69%	1	0.61793946	0.14725393	0.23480661					
30	155.05%	1	0.64843534	0.17207431	0.17949034	10 (0.86096635) 28 (0.13901626)	0	0	0.00000019	0.00064879
31	109.43%	1	0.62393954	0.16928575	0.20677471	10 (0.74742171) 28 (0.25257826)	0	0	0.00000937	0.00013212
32	108.82%	1	0.29301714	0.29458341	0.41239946	8 (0.56978490) 26 (0.43021492)	0	0	0.00000025	0.00001001

Appendix 13 - Correlation coefficients (r) and individual significance level (p-value) of the variables more correlated with the relative performance scores

Variables/Indicators	Resource efficiency CRS score		Cost efficiency CRS score		Effectiveness CRS & VRS score	
	<i>r</i>	<i>p-value</i>	<i>r</i>	<i>p-value</i>	<i>r</i>	<i>p-value</i>
AREA	-0.361410158	0.0421	-0.387469206	0.0284		
PFWRA					0.795936345	0.0000
PNFWRA					0.371614282	0.0362
AVGDAYSABS_A					-0.363494527	0.0409
AVGDAYSABS_D					-0.399513534	0.0235
DAYSABS_D					-0.382259268	0.0308
FWRA_A					-0.373575057	0.0352
FWRA_B					-0.387104853	0.0286
FWRA_H					-0.350547229	0.0492
IRFWRA_B					-0.402355905	0.0224
IRFWRA_H					-0.376055656	0.0339
IRNFWRA_B					-0.359763382	0.0431
IRNFWRA_C					-0.357590540	0.0445
LIAVGALW			-0.580215831	0.0005	-0.403163744	0.0221
LIAVGREM			0.389885255	0.0274		
LIAVGTRA						
LIEDU					0.382904874	0.0305
LISEN			-0.521569721	0.0022		
PDAYSABS_D					0.458363578	0.0083
PFWRA_B					0.402355905	0.0224
PFWRA_H					0.376055656	0.0339
PNFWRA_B					0.359763382	0.0431
PNFWRA_C					0.357590540	0.0445
STFAVGTRA	0.362233827	0.0416	0.482414339	0.0052		
STFSEN			-0.543886382	0.0013		
TFWRA					-0.50038998	0.0035
WARNOT					0.353383054	0.0473
Resource efficiency CRS score	1		0.825683394		0.065004314	
Cost efficiency CRS score	0.825683394		1		0.110827551	
Effectiveness CRS & VRS score	0.065004314		0.110827551		1	

Sources: Own elaboration, based on the EMS outputs and in the data from the ACT, GEP (2015), INE (2013) and Eurostat (2016).