



# Innovation for Development

Teresa de Noronha Vaz (Ed.)

Centro de Investigação sobre o Espaço e as Organizações  
Centro Regional de Inovação do Algarve  
Universidade do Algarve

# Regional competitiveness, technological adjustments and employment

*Teresa de Noronha Vaz  
Marisa Cesário*

## Introduction

Economic globalisation is leading firms to face an increasingly openness to rival producers, whatever their original location of production. Not only firms but also industries and regions are now much more vulnerable to price and quality competition.

Camagni (2002) suggests that regions compete on the basis of absolute competitive advantages, arising when a region possess superior technological, social, infrastructural or institutional assets, which are external to firms but of their benefit. The author assumes that territories compete with one another and both attractiveness and local competitiveness depend on similar common factors, which goes beyond physical conditions and refer to relational capital and the learning capacity expressed by the territory. This approach and other similar ones stress the discussion on how important is geographic proximity for the strategic positioning of firms.

In spite of the fact that some authors claim that the notion of distance is “dead”, arguing with the increasing globalisation processes as a tool for all over spread acquisition and diffusion of knowledge, other scholars assume the role of space and territory in creating competitiveness and better economic performance.

Bramanti (1999), for example, points out the interaction of four building blocks (innovation processes, learning mechanisms, governance structures and networking relations) in the process of innovation that presumes great relevance for the geographic space as a determinant variable.

Also recognising that individual companies are the ones that compete in the market, Camagni, 2002, remembers that most of the small and medium sized companies and respective entrepreneurs are to a large extent generated by the local context and, in order to face changing and uncertain economic conditions, their decision-making process is firmly based on socialised practices, thereby stressing the of geographic proximity as a mediating factor.

To the first group of authors belong Maskell and Malmberg (1998, 1999) who have used the term ‘ubiquitification’ as the outcome of the ongoing globalization process and meaning the process whereby former tacit knowledge gradually becomes codified. As they explain, in open markets and when knowledge of new technologies and new organisational designs become globally available, firms in low-cost areas become more competitive.

Nevertheless, the authors also recognise that no firm can build competitiveness on ubiquities alone. Most firms learn from close interaction with suppliers, customers and competitors and knowledge processes are deeply influenced by local resources, institutions, social and cultural structures (localised capabilities). When considering innovative activities, for instance, the importance of geographic proximity promoting interaction, has been defended by authors like Gambardella and Malerba (1999), Arndt and Sternberg (2000) or Cassiman and Veugelers (2002).

Inter-firm linkages, in the form of regional networks, are proven to be important prerequisites for successful innovation activities in firms. Similar approaches can also be found in Malmberg and Maskell (1997), Kirat and Lung (1999). In Vaz, Cesário and Fernandes (2006), the argument has been stressed even further up to the extent of detecting which exact factors of geographic proximity would be more responsible for innovative attitudes within the firm and why.

Indeed, the dead of geography' thesis cannot be sustained, since it wrongly assumes that the rapid diffusion of information and codified knowledge means the rapid diffusion of understating, and that is not correct (Morgan, 2004). Although organisational proximity is important, it does not substitute direct face-to-face communication. Another aspect is that some types of knowledge travel more easily than others. While analytical knowledge, which results from the application of scientific laws, has a relatively constant meaning by location, the same is not true for the synthetic or symbolic knowledge<sup>4</sup>, whose meaning is substantially variable (Gertler, 2008).

That is why, as explained by Scott *et al.* (2001) and Scott and Storper (2003), unlike the idea that globalization means the diffusion and spreading of economic activities, this phenomena has been accompanied by the affirmation of agglomerative tendencies as sources of economic growth. According to the authors, the most remarkable agglomeration forms are the, so called, 'city-regions', that act as locomotives of national economies as sites of dense interrelated economic activities with high levels of productivity and innovative potential. This is happening in both developed countries, where metropolitan areas are growing faster than others, and in the less-developed ones, where the effects of agglomeration on productivity are strongly apparent. These results support the idea that globalization and its consequent market opening and technological progress tended to reinforce urbanization, not the contrary. Both large-scale agglomeration and regional economic specialisation are persistent and growing phenomena: Firstly, the geographic proximity eases the dynamics of backward and forward inter-linkage of firms; Secondly, it allows the formation of dense local labour markets around multiple workplaces and third, it facilitates the emergence of localised relational assets promoting learning and innovation effects. The reasons for location proximity go beyond transactional efficiencies, and include various kinds of externalities, such as knowledge spillovers and dependence on human relations, rules and customs that enable firms to coordinate under conditions of uncertainty.

This is even truer when considering the specific case of small firms. Contrarily to big firms, SMEs interact intensely with the territory in which they locate, as a signal of their embeddedness. The particular tight links they develop with the external environment also reduce uncertainty risks. In general, SMEs do not only locate nearby the residence of their owners but also the geographical and sociological proximities constitute their main sources of assets and information (Julien, 1995). This fact determines the perspectives and strategic choices of the firms, because most of the market perception arises from the inputs that the territorial institutional context supplies them (Vaz, 2006). Growth determinants as competition capability, political understanding and knowledge of consumption behaviour do result from the external environment of the firm. Not surprising that the attributes of such environments become, therefore, a crucial factor for the

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4. By synthetic knowledge the author mean the application or combination of existing knowledge, mainly through interactive learning with customers and suppliers; symbolic knowledge means creating meaning trough highly context-specific learning-by-doing processes.

development of different entrepreneurship profiles.

Nevertheless, such external links by themselves are not sufficient to produce technological learning. Internal factors dealing with human capital and networking aptitudes within the firm are also important variables as demonstrated by Cesário and Vaz, 2008. This kind of approach had been much earlier developed by Cohen and Levinthal (1990) who argued that the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities. The authors label this capability as a firm's absorptive capacity. Also a similar idea is given by Julien *et al.* (1999) for whom the main factor distinguishing SMEs using new technologies from those continuing to use traditional equipment are the management quality and the organisation's ability to obtain and process technological information. The author define technological scanning as an activity through which the external information needed for technological change is gathered, analysed and disseminated in the firm. As proven by Cesário, 2009, as a result of different regional settings' attributes, entrepreneurs may develop different abilities allowing different entrepreneurial strategies, namely regarding technological adjustments.

Empirical surveys often mention the importance of entrepreneurship in helping peripheral areas (such as in Bennetworth, 2004), or the role of innovation in small firms to the competitiveness of rural environments (North and Smallbone, 2000).

## The Agent-Centred Perspective on Regional Competitiveness

Also pointing out the insufficiencies of neoclassical models Clark and Tracey (2004) reject the idea that economic agent's options are completely bounded by their regional sets. The agent-centred perspective, as labelled by the authors, assumes that agents or firms' strategic choices are not tightly dependent and derived from their contexts, but can be developed either through interaction or complete independent from those sets. Although not ignoring social, political and economic structures, as framing variables, the authors clearly reject that economic agents are chained to their historical or geographical conditions as they have the cognitive capacity to interact with them. One important presumption of this approach is the rejection of rational maximising behaviour theories. Facing the need of generalising and summing up individual behaviours, economic theory tends to marginalize the scope and nature of human decision-making process. The assumption of rationality means that all people choose the optimal according to their goals. To suppose otherwise is to suppose irrationality or, at least, inconsistency. The need to better understand empirically how and why people make their decisions, led to the acceptance of the fallibility of rationality<sup>5</sup>.

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5. According to Herbert Simon (1955) an 'economic man', as postulated by the traditional economic theory, is assumed to have clear knowledge of the relevant aspects of his environment and a well-organised and stable system of preferences. For the alternative courses of action available, he is able to choose the one that will permit him to reach the highest attainable point on his preference scale. This concept was a matter of drastic revision. In substitution, he suggests a 'choosing organism' of limited knowledge and ability, placed in an environment with which he interacts. The author use the concept of 'bounded rationality', explaining that rationality is bounded when there are failures in knowing all the alternatives, uncertainty about relevant exogenous events and inability to calculate consequences (Simon, 1979: 502). In order to characterise the mechanisms of choice under conditions of bounded rationality, he uses

At the end, this approach is all about recognising the importance of humans' cognitive skills. Although also recognising the influence of institutions on agent's choices, as the institutional-centred approach, the big difference between both is that the agent-centred model treat institutions only as resource endowments, so different regions, with different institutional settings, have different resource endowments affecting agent's decision-making and regional competitiveness (Clark and Tracey, 2004).

Accepting that different territories may provide different competitive conditions and following the arguments of the agent-centred perspective, agents should have the cognitive capacity to move from their inherited institutional contexts when these ones are not providing favourable conditions<sup>6</sup>. Hence, '*...the concept of embeddedness may neglect the capacity of agents to understand the world of which they are part*' (Clark and Tracey, 2004), as it implies that firms are passive in terms of their choices. As seen by Granovetter (1985) the argument of embeddedness applied to economic behaviour means that agents and institutions are so constrained by ongoing social relations that to consider them as independent is a serious misunderstanding (Granovetter, 1985: 482). Although recognising the importance of the concept, the agent-centred perspective rejects such constraint in agents' capacity.

Another important input from this approach regards the concept of inheritance. Contrarily to Arthur's assumption that social capital results from the positive feedback generated by the region-industry specific path accumulation process, Clark and Tracey (2004) explain that national and regional institutions and practices can be inherited rather than simply accumulated in a growth and development process.

While recognising the utility of the embeddedness and path dependence concepts, the present work is sympathetic with the agent-centred approach as it admits the possibility of the interaction between agent's cognitive capacities and their place-specific inheritances and endowments.

The capacity of agents to strategically adapt to European integration and globalisation is very much the result of that interaction. Given the importance of technological changes in this context, and having in mind the vulnerability of labour-markets in regions highly dependent on such sectors, the next section continues providing an overview on a set of empirical exercises analysing the impacts on employment deriving from firms' technological adjustment processes.

## Firm Behaviour and Regional Employment Structures

Social and institutional aspects impose the assumption that labour markets are not 'perfect': the new Keynesian economics recognizes that local labour markets are different from other markets focusing on spatial disparities in unemployment, wages or job conditions to create

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the concepts of search and satisficing: 'If the alternatives for choice are not given initially to the decision maker, then he must search for them...As soon as he discovered an alternative for choice meeting his level of aspiration, he would terminate the search and choose that alternative.'

6. Keeble's (1997) exercise on British regions allowed confirming the arguments that small firms, in less endowed regions such as the peripheral ones, may actively try to overcome environmental constraints by conscious strategies, perhaps involving greater R&D efforts.

local adjustments in demand and supply, while technological shocks are being processed in an unstable equilibrium (Martin, 2000).<sup>7</sup>

After recognising the existence of a two way flow of influences between agents and environmental sets, elsewhere argued, this section deals specifically with the impact on regional employment structures deriving from firms' technological adjustment processes.

More specifically, the next section reviews the theoretical discussion around the effects of technical change on employment and labour skills.

## The Impact of Firms' Technological Adjustments on Employment

The effects of technical change on employment have increasingly interested researchers. More even since unemployment is the greatest economic problem faced by developed countries.

For the public in general, and although recognising that innovation is a major driving force behind job creation, the concerns about the future of work as the diffusion of information technology proceeds, are present.

Chennells and Van Reenen (2002) survey the data on the effects of technical change on skills, wages and employment by examining the micro-econometric evidence at industry and firm level. The results from different countries were widely variable. Overall, the authors found consistently evidence for positive effects of proxies for product innovations on the growth of employment.

An example (Van Reenen, 1997) was found in the British firm-level panel data on innovative activity. The study identified the effects of technical change on jobs and confirmed the positive association between proxies for technical change and employment.<sup>8</sup>

Also, similar results were obtained by Enfort, Gollac and Kramarz (1999) when studying the effects of new technologies on employment in French firms or by Blanchflower and Burgess

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7. With regard to labour force adjustments, the work of Greenwald and Stiglitz represent an important theoretical reference. In 1989 the authors argue that, risk-averse firms tend to prefer changes in employment than changes in wages or hours. They explain that there is greater uncertainty associated with wage/hours decisions than with employment decisions. While changes in wages/hours affect all workers in unpredictable ways and generate uncertainty about profits (namely through changes in turnover derived from people quitting, changes in workers' effort, etc) in contrast, changes in employment seem to minimize the resulting uncertainties. Later (Greenwald and Stiglitz, 1990), the authors developed their argument by examining the implications of imperfect information for firm behaviour, namely firm adjustment behaviour in the labour market. Again they conclude that, firm output and investment spending (with the inevitable consequences on employment) respond directly to changes in firm wealth as well as to environmental uncertainty. A more in-depth advance concerning labour-market adjustments is given in Greenwald and Stiglitz (1995). According to the model developed, firms may be in one of three regimes: hiring, firing or doing neither. Over the course of a business cycle, they tend to move from the hiring regime to the intermediate regime (where firms rely primarily on hours and wages adjustments) to the layoff regime. This happens because, as firms' net worth decreases, their risk aversion becomes higher. Since wages/hours reductions are the adjustment variables associated to greatest uncertainty, firms will prefer to engage in layoffs. The authors explain that the sequence of observed adjustments should be the sequence of hiring reductions, followed by hours' reduction, and only after an interval, layoffs.

8. Other important remarks were: a) the greater is the sensitivity of consumers to price changes the more likely it is that an innovation will raise employment; b) the easier it is to substitute capital for labour the more likely it is there will be positive employment effects from technical change and c) if the firm has some degree of market power not all of the reduction in cost will be passed on in the form of lower prices. This will blunt the output expansion effect and make positive employment effects less likely.

(1998) who concluded that the introduction of new technology in UK and Australian plants was more associated to job growth rather than to job decline.

Zimmermann (1991) used data for German firms in order to evaluate the relative importance of three driving forces: technological advance, declines in demand and increases in labour costs, for the employment decline in manufacturing industries. The results pointed out that the lack of demand is a dominant factor in employment decisions. Technological advances appear in second, while labour costs place third.

Smonly (1998) used micro-data from West German manufacturing firms to estimate a model on the impact of innovations upon the output, capacity utilisation, employment and prices. The conclusions were that firms which implemented product innovations increase prices, exhibit a higher utilization and grow faster. Product innovations also affect positively the growth and volatility of employment, being this volatility higher with the lower price elasticity of demand, which favours employment adjustments against price adjustments to technical change<sup>9</sup>. Regarding process innovations, the results also indicate positive effects on output and employment, but not conclusive effects on prices and sales. The results point towards that both types of innovation generate positive effects on employment but do not indicate which effect is stronger.

Greenan and Guellec (2000) enriched the debate by explaining why product innovation produces lower effects than process innovation. Using French data, the authors found that innovating firms and sectors in general create more jobs than others and that process innovation, in particular, is more about job creation than product innovation. This is explained with the fact that product innovation creates more uncertainty than process innovation, as the reaction of consumers to a new product is highly unsure. Employment decisions are consequently affected, accordingly to the authors.

Different results come out when considering organisational innovations. Osterman (2000) found that measures of new organizational practices are associated with higher layoff rates of production workers, even within firms that have been experiencing net employment gains. A confirmation on these results was obtained by Black, Lynch and Krivelyova (2004) when examining the relationship between what the authors called HPWPs - *High Performance Workplace Practices* and employment changes: "Some practices, such as self-managed teams, are associated with greater employment reductions, whereas other practices, such as the percentage of workers involved in job rotation, are associated with lower employment reductions" (Black, Lynch and Krivelyova, 2004: 65). The work also suggests that there are significant differences between unionized and nonunionized employers in the impact of organizational change.

The use of R&D measures as proxies of innovation, generate negative correlations: Brouwer, Kleinknecht and Reijnen (1993) used R&D data from Dutch manufacturing firms to analyse the influence of innovation on growth rates of employment. They conclude that the growth of the R&D intensity of firms has a slightly negative impact on employment, whereas firms with a high share of product-related R&D experienced an above average growth of employment. The same was the case with Klette and Førre (1998), for Norwegian manufacturing plants, were no positive relationship between net job creation and the R&D-intensity of a firm were found.

These results clearly indicate that the effects of innovation depend critically on the type of

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9. Similar relations were found in Van Reenen's (1997) model.

innovations being produced. While technological advances more product and process oriented are generally associated with job growth, even if with different intensities, organisational changes and R&D intensity produce frequently negative impacts in the growth rates of employment.

## The Impact of Firms' Technological Adjustments on Labour Skills

The idea that technology could lead to a *de-skilling* of workers, with mass production factories symbolising the destruction of skilled artisans, is being contested by recent economic debates, focusing on whether modern technologies are generally biased towards more skilled workers.

Berman *et al.* (1994) investigated the shift in the demand from unskilled toward skilled labour in US manufacturing over the 1980's. The authors conclude that this shift is mostly due to technological adjustments (e.g. investment in computers and in R&D) rather than shifts in product demand due to trade competition. Very similar results were obtained by Hansson (2000) for Swedish manufacturing firms.

Also Doms, Dunne and Troske (1997) found evidence of skill bias when examining the relation between technological advances and the demand for work. Also using computer investment as a measure of technology use, the authors found a positive association between this indicator and the growth of skilled workers during the period of observation.

Autor, Katz and Krueger (1998) corroborated the importance of technical change (especially computer use) in accounting for the increase in the proportion of skilled workers. The analysis of US industries indicates that the rate of skill upgrading has been greater in more computer-intensive industries.

Machin and Van Reenen (1998) compared the U.S. results in terms of changing skills structures with six other OCDE countries (Denmark, France, Germany, Japan, Sweden and the UK). Using R&D intensity as a measure of technical change, the results indicate a significant association between this measure and the demand for skilled workers across the different countries.

Also using R&D intensity as well as technological capital intensity, Aguirregabiria and Alonso-Borrega (2001) analysed a panel of Spanish manufacturing firms and conclude that the decision of adopting new technologies is countercyclical and has a much stronger effect on the occupational structure of the workforce than the accumulation of technological capital by old innovative firms.

Considering organisational changes, Caroli and Van Reenen (2001) examined a panel of British and French establishments and found that organisational change reduces the demand for unskilled workers as well as leads to greater productivity increases in establishments with larger initial skill endowments.

Independently of the measure of technology used, there is considerable empirical evidence supporting the idea that technological related strategies favours the increase in the demand for more skilled labours.

## Conclusion

Against the theoretical trend defending the idea that agents simply respond to their environmental conditions, with little or no capacity for strategic choice, the agent-centred approach consider agent-environment interaction as a two-way flow of influences: the behaviour of agents can influence their context, such as environmental conditions can promote or not proactive attitudes towards innovation.

Local settings influence firms' choices, as their strategic options are encouraged or inhibited by their contexts. Although is very difficult for small firms (for instance) to control those contexts, is also argued that firms' strategic decisions can '...shape the boundaries of its environments...' since decisions with regard to location, markets explored, customers pursued, technology adopted or training provided can, in fact, manipulate aspects of the environmental sets (Clark and Tracey, 2004) .

The recognition of firms' capacity to strategically respond and adjust to new economic conditions, with the consequent influences on regional sets, is followed by the discussion of the impacts on employment and labour skills resultant from firms' technological strategies.

The observation of several empirical exercises suggests that technology is, on average, biased towards skilled labour. The evidence on the effects of technology on total employment is more mixed, with some measures (diffusion-based) suggesting a positive association and others (R&D-based) being more negative (Chennells and Van Reenen, 2002).

Vaz *et al.* (2006) and Vaz and Cesário (2008) confirmed that such interactions may have positive effects that go beyond the firms themselves, and influence the broader socio-economic context in which they operate. Using data for a set of European regions (INNOVALOC, 2000) the authors conclude that a two-way flow is established for which regional or local characteristics influence innovation in small firms while the regional economic development is affected by the innovative behaviour of the firms themselves. In the case of lagging regions, technological change can only be discussed in a context of interface between institutional interaction and historical local development. The main reason for this is the strong role that SMEs play in their socio-economical structures and in particular in employment and skills development. Therefore, the dynamics of local development are closely related to entrepreneurial strategic choices and vice-versa, small firms have their roots deep within the environmental local conditions.

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