

**UNIVERSIDADE DO ALGARVE
FACULDADE DE ECONOMIA**

**REGIONAL INNOVATION SYSTEMS BASED ON LOW TECHNOLOGY
INDUSTRIES IN DEVELOPING COUNTRIES: SALMON INDUSTRY IN
CHILE**

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DOUTORAMENTO EM INNOVATION AND LAND USE MANAGEMENT

FARO
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(Regional Innovation Systems based on Low Technology Industries in Developing Countries: Salmon Industry in Chile)

DOUTORAMENTO EM INNOVATION AND LAND USE MANAGEMENT

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ABSTRACT

In 1980, the salmon industry became one of the main Chilean export activities". Indeed, this activity has experienced significant and explosive growth positioning Chile in the last ten years as the second largest exporter of this product with 30% of the international market after Norway (50%). The salmon industry is mainly located in the Los Lagos region and has become a key strategic economic sector to promote the regional development.

In order to understand about the potential emergence of industrial cluster or, eventually, a Regional Innovations System (RIS) based on this competitive low technology industry, it is important to understand to what extent innovation activities are the result of individual processes and to what measure new knowledge creation is being the result of dynamic and interactive processes where there is a systematic use of structural regional conditions. For example, the presence and emergence of linked and coordinated actors, proximity, specific knowledge and norms that arise from the path of an economic regional specialization as well as the result of the exploitation and absorption of regional externalities through knowledge spillovers. The present Chilean case study is based on a qualitative and quantitative methodology in order to analyse the existence and the stage of development of specific variables that are required to comprehend the evolution of a RIS. Most of the information has been collected through the application of interviews to regional stakeholders and a survey was applied to representative salmon industry firms, obtaining a preliminary and panoramic vision of the most important variables configuring a RIS.

From the analysis carried out by this research, the results show that the consolidation of the low-tech Salmon Cluster in the Los Lagos region has not developed the principal factors permitting the consolidation of a RIS. On the contrary, regarding a RIS approach to analyze the national and regional innovation policies, the functional organization and the

history of the salmon industry in Los Lagos and the view of the main regional actors, public and private institutions, there are important gaps in terms of the regional conditions to generate innovation. In this case, the business development and innovative behavior of a competitive rural industry such as salmon industry does not provide the conditions to promote a RIS.

Key words: Salmon industry, Innovation, Los Lagos Region, Regional Innovation System.

RESUMO

Desde 1980 a indústria do salmão tornou-se uma das principais atividades económicas de exportação do Chile. Esta actividade tem experimentado um explosivo crescimento, tornando o Chile no segundo maior exportador deste produto com uma participação de cerca de 30% do mercado internacional depois da Noruega (50%). A indústria do salmão está localizada principalmente na região de Los Lagos e tornou-se um setor económico estratégico para impulsionar o desenvolvimento regional da região.

A fim de estudar a possibilidade de aparecimento de clusters industriais ou, eventualmente, de um Sistema de Inovação Regional (RIS) com base numa indústria como baixo desenvolvimento tecnológico, é importante compreender em que medida as atividades de inovação são o resultado de processos individuais e em que medida a nova criação do conhecimento é o resultado de processos dinâmicos e interativos, onde haja uma utilização sistemática das condições regionais estruturais. Por exemplo, a presença eo surgimento de atores ligados e coordenados, proximidade, conhecimento específico e normas que surgem a partir de uma especialização regional económica e também o resultado da exploração e absorção de externalidades regionais através de transbordamentos de conhecimento.

O presente estudo de caso chileno utiliza metodologias qualitativa e quantitativa, a fim de analisar a existência e o estágio de desenvolvimento de variáveis específicas que são necessárias para compreender a evolução de um RIS. A maioria da informação foi recolhida através da aplicação de entrevistas aos intervenientes regionais e uma pesquisa que foi aplicada a empresas representativas da indústria do salmão, permitindo obter uma visão preliminar e panorâmica das variáveis mais importantes que permitem a configuração dum RIS.

A partir da análise realizada por esta pesquisa, os resultados mostram que as condições para a consolidação do Cluster de Salmão na região de Los Lagos ainda não permitem desenvolver os principais fatores para a consolidação de um RIS. Pelo contrário, considerando uma abordagem RIS que incorpora as políticas de inovação nacionais e regionais, a visão dos principais atores regionais, a organização funcional e da história da indústria do salmão em Los Lagos, ainda existem gaps importantes em termos das condições regionais para gerar inovação. Neste caso, o comportamento do cluster do salmão, apesar de ser altamente competitivo não tem permitido gerar na região um comportamento inovador conducente à aparição de um RIS.

Palavras-chave: Indústria do Salmão, Cluster, Inovação, Região de Los Lagos, Sistema Regional de Inovação.

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ABBREVIATIONS AND ACRONYMS

RIS	Regional Innovation System
NIS	National Innovation System
OECD	Organisation for Economic Co-operation and Development
DP	Gross Domestic Product
MERCOSUR	Common Market of the South
SEREMI	Regional Ministerial Secretary
DIRECTEMAR	General Bureau of Maritime Territory and Merchant Marine
CONAMA	National Commission of Environment
SERNAPESCA	National Fisheries Service
CORFO	Chilean Economic Development Agency
FONDEF	Fund for Support to Scientific and Technological Development
IFOP	Fisheries Development Institute
SENCE	Training and Employment National Service
FONDECYT	National Fund for Scientific and Technological Development
STI	Science Technology and Innovation
DUI	Doing Using Interaction
CCI	Combined and Complex mode of Innovation
SME	Small and Medium Enterprise
ICT	Information and communications technology
TNC	Transnational companies
CRA	Constructed Regional Advantage
UE	European Union
FDI	Foreign direct investment
GEM	Global Entrepreneurship Monitor
PILOT	Policy Innovation in low tech industry
HDI	Human Development Index
NAFTA	North American Free Trade Agreement
INTESAL	Technology Institute of Salmon
SEIA	System of Environmental Impact Assessment
UTM	Monthly Tax Unit
WTO	World Trade Organization
ISO	International Organization for Standardization
NGO	Non-Governmental Organization
SIGES	Integrated Management System of Salmon
SOFOFA	Industrial Development Society
ISA	Infectious salmon anemia
SERPLAC	Regional Secretary of Planning and Coordination
FIA	Agricultural Innovation Foundation
PROCHILE	Exportation Promoting Agency
FIP	Fund for Fisheries Research
PTI	Territorial Program of Salmon Cluster
ARASEMAR	Regional Association of Shipowners and Maritime Services
CONYCIT	Scientific and Technological Research National Committee
UNDP	United Nations Development Programme
SUBDERE	Undersecretary of Regional and Administrative Development
CASEN	National Socioeconomic Survey

CHAPTER I: INTRODUCTION

1. Contextualization of the research

Different factors such as the incorporation of new technologies, the globalization process, the increasing liberalization of markets (labor markets, flows of products and investments among countries and others), the incorporation of new producers and potential markets as China and middle eastern countries to the international economic sphere, new customers dynamics and others, have had an important repercussion on the competitiveness of markets, generating the necessity to improve and accelerate the productive process of firms; small, medium and big firms have had to innovate

constantly on their products and services in order to survive and maintain their competitiveness. Regarding Schumpeterian differentiation between innovation and invention, innovation can be broadly understood as the process where an idea is used effectively in the practice (Schumpeter, 1934).

The development and progress of science and technology as well as information and communication technologies in advanced economies have enhanced productivity and spread it to a greater number of individuals, firms and countries, pushing them to advance to a knowledge based economy. In the past, research was largely entrusted to governments and to the scientific community itself. Today a greater attention needs to be given to more and various issues, focusing on the interface between science systems and industrial innovation, human resources for science, technology and innovation, and international S&T collaboration. As innovation becomes more science-intensive and firms increasingly acquire scientific and technical knowledge from external sources, businesses have a more intensive use of public research (OECD, 2004a).

Considering an economic geography perspective, new features of the market (Malerba, et al, 2003) have set new patterns in spatial reality linked to flexible production systems and the use of new technologies in firms (Piore & Sabel, 1984). The focus on the spatial variable from the evidence of the concentration of economic activities in the theoretical debate (Bertuglia, et al, 1997, Malmberg & Maskell, 1997, Audretsch, 1998, Maskell & Malmberg, 1999, Fujita, et al, 2000), have resulted in the development of intervention policy programs with special focus on the Regions as an appropriate scale of analysis taking into account the importance of proximity (Kirat & Lung, 1999) and externalities in economies of agglomeration (Gordon, et al, 2000, Scott & Storper, 2003, Bönte, 2008).

Likewise, the theoretical and empirical debate about concepts of competitiveness and innovation such as "Innovation Systems" (Lundvall, 2007) and "Regional Science" (generated mainly by theories of regional development) allowed the apparition of the concept "Regional Innovation Systems" (RIS), that it is understood as the institutional infrastructure that support the innovation of the productive structure in a region (Asheim & Gertler, 2005). It is configured in a region, a social system where innovations occurred as the result of interactions between economic actors within an open system (Asheim &

Isaksen, 2000, Isaksen, 2001, Evangelista, et al, 2002, Cooke, 2003, Andersson & Karlsson, 2004, Asheim & Coenen, 2004, Bracayk, et al, 2004, Doloreux & Parto, 2005). Complex systems can be fed back through a mechanism of new knowledge production, based on accumulated local knowledge and learning process (Hudson, 1999). The dimension of this system arises from the members of the regional networks that make it up: large and small firms, industry, entrepreneurs, educational institutions, R&D laboratories, members of trade and a government structure (Storper, 1995), in which there are "Networking" relationships (Singh, 2005). This entails a sub-national level based on an organizational and collective learning process (Capello, 1999) and associativity, a regional system capable of generating an environment of competitiveness and innovation (Sternberg & Arndt, 2001). It is an inclusive system for all development actors involved in the region (Howells, 2005, Cooke, et al, 2007), stressing that industrial and development strategies in regional bodies has greater feasibility of impact because they are efficient in capturing differenced and decentralized policies, allowing the application of specific instruments to each regional reality.

The efforts linked to economic development have focused mainly on the generation of public policies and strategies to promote development at both national and regional level stimulating an environment of competitiveness and innovation that encourages entrepreneurship, business productivity, stimulate economic growth and create jobs (Acs & Varga, 2005).

In this context, the necessity to understand regional features taking into account the location and proximity of firms, networking, informal business systems, lower transaction costs, motivations generated by competition, generation and dissemination of information, and knowledge spillovers as an input for innovation (Paci & Usai, 2000, Breschi & Malerba, 2005, Fischer, 2006) is stressed. Other important regional factors that should be considered are socialization in the use of new technologies and specialized inputs, options for collective responses to complex needs, new opportunities, and specific spaces where it is possible to find an environment of competitiveness and innovation based on synergy and learning. The analysis and interpretations of the new economic geography and the various inputs that have expanded their state of theoretical development (Noronha Vaz & Nijkamp, 2009) have been very important to demonstrate also the importance of external sources of

knowledge to innovative firms (Simmie, 2002, Audretsch & Feldman, 2004, Hirose & Yamamoto, 2007, Christ, 2009).

In many ways there is some consensus of the understanding and explanation of these new dynamics, considering the importance of variables that are inherent to the territory on a regional scale, being understood as a system that incorporates several areas including politics, culture, geography, economics, etc. (Albuquerque, 2000).

2. Scope of the study

In the last ten years, the efforts of the Chilean Government, institutions and public policies in the field of innovation and competitiveness have been constant (Benavente & Price, 2014, Consejo Nacional de Innovación para la Competitividad, 2006). In order to overcome current Chilean economic and industrial policies based mostly on the exploitation of comparative advantages (resulting mainly from exporting and limited commodities) have stressed new development strategies based on the stimulation of a knowledge economy, supporting research and human capital, technological development and innovation activities in order to generate new competitive advantages (Porter, 1990, Eyzaguirre, et al, 2005).

Likewise, the emergence of spontaneous geolocalized groups of low-tech competitive rural industries based mostly in the advantages of natural resources (Mining, Salmon industry, Wine) in different regions of Chile, have left the evidence that certain basic but competitive economic activities in each territory are capable of stimulating the business performance and firm creation, increasing employment and creating a virtuous circle, where market competitiveness generates new areas of development (Ramos, 1999).

However, despite the important recent efforts and policies to increase Chilean productive advantages in order to capture new opportunities in a knowledge based economy, most of the Gross Domestic Product (GDP) incomes are still provided by resource based industries, some of them, such as salmon industry, becoming an

important source of regional incomes and the engine of regional development. The salmon industry, specifically, has become an important economic activity contributing to almost 30% of total regional GDP of the “Los Lagos” region and 3.5% of national GDP. In 2014, Chilean exportations from the salmon industry reached \$4 billion US generating in the same year 800,000 tons of salmon, maintaining thus its position as the world's second largest producer with around 30% of global output after Norway that accounted for 50% of total production.

Natural resource based industries such as the salmon industry show a reduced tendency to generate systematic radical product innovations because they are mostly based on the natural conditions of regions and less on competitive advantages (such as skilled labor resources, intense use of technologies and knowledge). However, salmon industry can systematically improve its productive processes, increasing efficiency of the economic activity. This happens through the incorporation of new technologies: new specialized suppliers arising to fulfill market gaps in terms of value chain bottlenecks, new facilities in terms of public and private support, specific knowledge generated for specific tasks, and augmenting sustainability of the sector, etc. The process can encourage regional entrepreneurship and innovation activities, ultimately boosting competitiveness of the sector, generating a positive regional labor capacity and a positive dynamic for the markets.

The salmon industry has been studied regarding different areas such as economic evolution and social impacts (Bjørndal and Aarland, 1999, Olson, and Criddle, 2008, Fløysand, et al, 2010), environmental impacts (Buschman, et al, 1996), Salmon Cluster (Montero, 2004, Vera, 2009, Perez-Aleman, 2005), interactions and networks (Felzensztein, et al, 2010) and proximity (Boisier, 2011). However, there is still missing a sectoral approach of salmon industry that incorporates in the analysis a systemic framework in the context of RIS.

Notwithstanding there have been important improvements in the field of innovation policies that emphasize the promotion of Clusters as a base of Chilean economic growth and development, although the debate and the support of specific policies is still in the initial state.

New research and efforts are mandatory as an asset for policy makers and regional and national actors to build and implement focused long-term programs and projects based on a Regional Innovation Systems (RIS) approach as a strategy to increase the competitiveness of the region. In particular, these efforts in Chile can be used as a critical instrument to advance in the challenge to reduce poverty, augment employment rates in sustainable economic areas, contributing directly to the promotion of economic growth and social development. In this context the following question arises; which are the main variables related to the regional innovation that have emerged from the salmon cluster and to what extent the development of each variable such as networking or associability allows the emergence of a RIS?

3. Objectives

Innovation activities in salmon firms can be visualized as isolated efforts, or considered as the result of dynamic processes where there is a use of regional externalities through knowledge spillovers and interactions.

The main objective of the thesis is to analyse the role played by a competitive resource-based industry in Chile in view of the promotion and consolidation of a RIS. In that context, it is necessary:

- To characterize innovation behaviour of salmon firms in the “Los Lagos region.
- To identify if the increased specialization and competition of the salmon industry have generated regional prosperity, contributing to promote a RIS.
- To identify main linkages and roles played by the key regional actors to foster innovation in the salmon industry.
- To examine to what measure innovation activities are the result of proximity and interaction facilitating knowledge diffusion and information.

- To generate regional policy proposals in order to support firm competitiveness such as interaction instance or absorption capacity of firms increasing the role of the RIS being able to promote economic growth and regional development.

In order to shed light about how innovation processes in salmon industry occur in the Los Lagos region in Chile, a preliminary vision of the main stakeholders of this sector was developed. It was done from the perspective of knowledge spillovers, interaction processes and national and international networks among different regional agents (salmon firms, universities, public sector, customers and other institutions). This was complemented by a theoretical revision of the recent advances in the salmon industry and innovation.

CHAPTER II: METHODOLOGY

1. Methodology and Regional Innovation Systems

Innovation systems have been considered as an important instrument to reach economic growth. One of the most important changes in this matter was the reconsideration of the scale of analysis to understand economic performance and technological competitiveness. Innovation policies were rethought from a national level toward a regional level. According to Fischer (2006) there isn't a particular reason to prefer a national scale over sub-national scales of innovation systems.

Primarily, it is highly important to justify the reason that support the use of the concept of RIS to analyse in what measure the development of a very competitive industry, the salmon cluster, may generate the main elements to the conformation a RIS.

According to Cook (2001), Regional Innovation Systems are composed of two subsystems that interact in a systematic learning process and in a particular socio-economic and cultural context of the region; a subsystem of knowledge generation in

which participates universities, research laboratories, technology transfer agencies and others, and a subsystem that exploits the knowledge produced by the regional production structure, comprised mainly of firms. Both subsystems coexist with a subsystem that is composed by government organizations and regional development agencies.

These subsystems conform an open RIS able to interact with other innovation systems in order to commercialize new knowledge. In this context, it is important to analyze how the region and main regional agents operates and how various subsystems are organized to generate new knowledge. According to Cook (2005), it is appropriate on the one hand, the understanding of various forms of regional governance for the development of policies that are capable to generate socioeconomic development, and secondly, what are the main determinants or factors allowing the process of innovation and regional learning.

Considering these theoretical elements we decided to use the concept of RIS in order to structure the analysis of the different institutions and organizations involved in the regional system and thus understand the role and function that each performs and how they interact with each other to generate an innovation process. In this sense, the question being answered is whether the institutions and organizations that are currently present in the region (which includes the production system or Cluster Salmon Industry) have actually contribute to generate a virtuous relations between them and if they allow the existence of a system of generation, absorption and systematic exploitation of knowledge in the region.

Taking into account the reasons justifying the use of the concept of RIS (and not the cluster) for the development of this thesis, we consider that the more traditional concept of Cluster (used by Porter in his book "The Competitive Advantage of Nations"), does not emphasize the importance of geographical proximity and the presence of "partner institutions" for the development of a territory.

According to Navarro (2009), studies of Cluster are mainly focused in firms and certain conditions that allow increment their competitiveness. However, there are some geo agglomeration may function and develop positively without the need for partner institutions, which for the concept of RIS it is impossible.

In the same context, considering that the salmon industry is conformed and featured by a group of companies that produce a particular product and use common technologies in an industrial sector, it could be argued the possibility to develop this study using the conceptual framework of this thesis considering the perspective of sectoral innovation systems (Breschi and Malerba (1997)). However, the limitations of this approach are mainly two. The first is linked to the lack of geographical boundaries of the industry (because the boundaries encompass the functional characteristics of the industry) making difficult the generation of public policies which identify specific tasks and responsibilities to local agents considering the administrative functioning of the region. The second limitation is related to the accurate view of this approach, because sectoral innovation systems are mainly understood considering the role and behavior of firms. However, for the present study that can be a narrow view regarding the importance that has had some partner institutions to the promotion of the salmon industry.

On the contrary and according to the objectives of this thesis, the RIS approach puts a special emphasis on the creation and exploitation of knowledge and therefore all the actors involved in this process have the same degree of importance. In other words, it underlines the need to analyze the presence of a formal and informal governance structure, where government agencies have political responsibilities and specific resources to design public policies in order to promote the operation and organization of the system.

Considering these conceptual differences between RIS and cluster approach (which are also explained in the theoretical framework, Chapter III), it is highlighted in this thesis the need to understand the salmon industry in Los Lagos region from a broad perspective, which considers besides the particular operation of the salmon industry, the processes of learning at local level and its links with other sectors and organizations and institutions of the region and its environment. Additionally, we are interested in knowing whether or not the cluster of salmon, has succeeded in generating and transferring regional coordination and broader learning processes, which include for example the emergence of new industries.

Finally, an important factor to prefer the concept of RIS as a conceptual framework to develop the study is related to its use as a theoretical tool for the generation of public policies to promote innovation and the learning. Those initiatives and programs may correct the shortcomings and gaps for the generation of RIS in peripheral regions where there is a predominance of industrial sectors featured by the intense use and exploitation of natural resources.

According to Navarro (2009, pp. 51), "the use of RIS in order to guide public action is considered especially useful for remote and peripheral regions, because usually the empirical analysis has shown that there is no a RIS ". Additionally, is underpinned the importance that is given to the socio-political and cultural context of the region, formal and informal relationships such as collaborative initiatives and trust among regional agents to the promotion of innovation in a territory.

2. Methodological problems of Regional Innovation Systems

Several authors have stressed the difficulty of empirical studies to verify whether a geographical area meets the sufficient criteria to generate a RIS (Doloreux and Labor, 2005). This study also considers some ambiguities in the study of RIS such as problems with characteristics and theoretical conceptualization of the RIS, lack of aggregate data and information sources capable to cover all the variables and dimensions that can be used to the configuration of a RIS.

According to an extensive review of research literature related to RIS, Navarro (2009), notes that a large number of studies use qualitative methods in order to understand the peculiarities of the territories and their unique innovative features using information concerning the firms characteristics, interrelations of regional actors, learning processes, etc. Moreover, the large amount of RIS studies are focused on successful regions, with strong industrial sectors related to manufacturing and knowledge-intensive. However, there are still a few studies considering rural or peripheral regions, with emerging systems or rural productive structures.

3. Main research questions of the study are;

- Is it possible that the business development and innovative behavior of a competitive rural industry generates conditions to the promotion of a RIS?
- What opportunities have to be supported and what bottlenecks have to be overcome for the consolidation of a RIS?

In order to answer those questions, research has been developed considering analyses and instruments of qualitative (Clark & Fast, 2008, Phillimore & Goodson, 2004) and quantitative methodology. The development of a case study (Yin, 2003) based on the “Los Lagos” region in Chile has also been considered in order to analyse the performance of the salmon industry as the main regional economic activity.

Final results allowed us to understand specific dynamics of a very competitive economic activity worldwide in a developing county. The Los Lagos region is a comparatively lagging region in terms of employment and regional GDP, however, natural conditions have allowed the apparition of competitive resource-based industries contributing to regional social development.

In order to answer those two main research questions, it was used a quantitative and qualitative methodology;

4. Methodology

4.1. Qualitative Analysis

The qualitative methodology was used in order to understand how public and private organizations that are currently part of the salmon cluster are effectively positioned as components of a potential innovation system in the region, how they contribute to the construction of regional institutionalism and to what extent these efforts allow the generation of a RIS based on the accumulation and diffusion of specific knowledge, interaction and learning.

Different regional organizations were considered as important key elements related to salmon industry in the region. Thus formal and informal visions of key regional actors about regional dynamics and innovation behavior in this industry were collected. Formal views of regional stakeholders (Freeman, 1984) are usually shaped by legal bodies of regulations and innovation promotion synthesized into specific tasks of their regional organization. However, many times informal discourses shed light in a better way of how social systems have been built, how they have evolved to the creation of a regional innovation support and in what extent key regional actors are linked.

Information was collected using a semi-structured interview. A flexible interview guide with open questions was used in order to not limit interviewees in order to reach the best degree of depth in their responses (See Annex 1). In this context, an important body of informal and specialized discourse was collected by 25 interviews, obtaining deeper information from stakeholders and high leaders of regional organizations linked to the development of salmon industry.

This primary information obtained through the use of extensive interviews will be studied by content analysis using ATLAS.TI software tool. Main discourses were analyzed through the classification and categorization of specific topics and sub-topics allowing for the finding of correlations among variables considered in the function of research objectives, common speech and key differences about certain points. The analysis of the information collected from interviews was completed with secondary information.

4.1.1. Instruments and primary information (Interviews to Regional Actors)

A total of 25 structured interviews were carried out. They were structured around the main variables identified for the development of a RIS (See Annex 1).

Following the interview guide, the interviews were conducted in the Los Lagos Region during November of 2012. Each one took 40 minutes to one hour, except in 2 cases, in which the interviews were written via e-mail, due to scheduling difficulties on behalf of the interviewees.

4.1.2. Methods; Content Analysis

In accordance with the volume of text material generated in the interviewing phase, and with the specific goal of understanding the ideas and notions that are shaping the local scenario for a RIS development in Los Lagos, a content analysis was undertaken using the software Atlas.ti.

This software is basically an organizing tool for large volumes of textual content. It facilitates classification of what the investigator defines as information, and in this sense, it will always rely on the research criteria (Strauss y Corbin, 2002). Therefore a series of stages were developed in order to reach a manageable and significant set of analysable material.

Firstly, the 25 transcriptions were categorized according to the type of institution that was attained. Thus we arrived at 4 main groups of text:

I. Governance Institutions:

- Regional bureau of the Ministry of Economy
(SEREMI Economía)
- Regional bureau of the Ministry of Health
(SEREMI Salud)
- Regional bureau of the Ministry of Environment
(SEREMI Medio Ambiente)
- Regional bureau of the Ministry of Social Development
(SEREMI Desarrollo Social)
- Military department of sea control
(DIRECTEMAR)
- National Fishing Service
(SERNAPESCA)
- Sub-secretary of Fishing
(Sub-secretaría de Pesca)

- Coast Activity Regional Commission
(Comisión Regional de Uso Costero)
- Labor Bureau
(Dirección del Trabajo)

II. Financial Support Institutions:

- Production Support Corporation
(CORFO)
- Scientific and Technological Development Fund
(Fondef, of the Ministry of Education)
- Chile Foundation
(Fundación Chile, of HPBilliton-Escondida Mine and Chilean Government)
- Regional Government Fund for Competitiveness and Innovation
(GORE-FIC)
- Fishing Foment Institute
(IFOP)
- Pro-Chile
(Exportation support from Foreign Affairs Ministry)

III. Researching and Educational Institutions:

- Salmon Chile A.G.
(Trade Association of Salmon Industry)
- Employment and Training National Service
(SENCE, of the Ministry of Labor and Social Welfare)
- Austral University
(Universidad Austral)
- Los Lagos University
(Universidad de Los Lagos)
- University of Chile
(Universidad de Chile)

IV. Municipalities:

- Ancud Municipality
- Puerto Montt Municipality
- Quemchi Municipality

Secondly, the texts were thoroughly examined. During this examination it was established that there were differences in content between groups of interviews and even within groups. Taking this into account it was determined that a set of general codes would be defined for all interviews, but each group would also have their own specific codes to retrieve these differences for further analysis. This flexible strategy allowed for attaining a more complete characterization of the salmon industry conditions for the development of a RIS.

Atlas.ti software facilitates not only the codification in response to pre-defined criteria, but it also allows for the identification of emerging distinctions from the texts themselves, giving a mixed result that includes novelties not foreseen previously, and ultimately enriching analysis (Strauss y Corbin, 2002).

4.1.3. Analysis; Atlas.ti Coding

As a third stage of analysis, after the examination of the content of the interviews, a set of codes were defined. These codes were primarily words and expressions that were found closely and persistently associated to the key concepts established in the questions (which were mainly: Salmon industry, Networking & Associability, Knowledge, Innovation, and National–Regional scale).

4.2. Quantitative Analysis

In order to increase the information and scope of the analysis, a complete survey was conducted to include the vision of the private sector; transnational and local salmon industry firms that actively participate in the region as salmon producer agents.

The primary information provided by the survey have allowed us to understand in what measure firms can be positive (or negative) affected by regional innovation factors such as:

- Regional knowledge sources and information used to develop innovations
- Networks, collaborative and cooperative projects with other regional, national or international agents
- Regional linkages and type flows with other regional agents
- Participation in specific regional programs to generate innovation (micro and small enterprise support, capital support, training, etc.)
- Importance of regional geographic and technological proximity with other firms and regional agents
- Regional cooperation and trust to develop cooperative business initiatives
- Main obstacles and hampers to generate innovation

This systemic analysis allowed a critical view of innovation proposals in order to promote specific factors that have not been taken into account in the current policy body, and to stimulate and foster other less developed elements in the socio economic system such as coordination among regional public and private institutions, regional policies to promote sectoral innovation, and regional networking initiatives, among others.

The questionnaire from the survey applied to 30 salmon firms (See Annex 4) has been designed with the aim of collecting quantitative data to understand innovation processes of representative salmon industry firms and analyse if some innovation efforts of these firms are favored or stimulated by specific regional innovation conditions.

4.2.1. Instruments and primary information (Application of the Survey to Salmon Firms)

The design of the questionnaire of this survey has been raised with the aim of collecting quantitative data relating to the processes of innovation and the perception of different firms of the salmon industry regarding the presence of a RIS in the Los Lagos region.

The sample consisted of 52 Salmon firms, whose main functions were related to the salmon industry in the Los Lagos region, either as a supplier, hatchery stages, producing eggs, food plants or laboratories.

The sampling unit were entrepreneurs in the industry, primarily businessmen and professionals on charges related to the commercial area or human resources.

The questionnaire had an approximate development time of 15-30 minutes. It was applied by the interviewer in the workplace or a place previously agreed upon with the respondent, usually in different offices located primarily in the cities of Puerto Montt and Puerto Varas in the Los Lagos Region.

4.2.2. Implementation of the Instrument

- **First implementation of the Instrument**

Initially, an online questionnaire was made, working with a sample of enterprises provided by the Association of Salmon firms in Chile “SalmonChile”. An e-mail was sent to the owner or general manager of the salmon firm, providing an on-line questionnaire.

For this first application of the instrument, the response rate was about 8 questionnaires, corresponding to a total sample of 30 firms, obtaining a 27% on the achievement in the implementing of the instrument.

The low response rate can be attributed to the type of questions, mostly related to administrative development of firms, which they can be consider as confidential. Furthermore, as the survey was on-line, it was quite difficult to present the aim of the

survey or an instructive to understand in a better way the context of the questions or further information about the study.

It is also important to consider the type of manager or director of companies related to salmon firms in the region, because they are individuals who have positions of great responsibility and it may be they did not have time or willingness to complete a questionnaire received by email.

- **Second implementation of the Instrument**

Due to the low percentage of completed questionnaires through the online system, it was decided to design a new questionnaire. Thus the application of the survey was made by an interviewer directly with salmon firms in the Los Lagos region.

This stage had a duration of four weeks which involved the consolidation of the database; a process of schedule of the interviews, the field application of the questionnaire and SPSS data entry.

- First Week: Working cabinet, database and first contact with companies in the sample consolidation. Coordination process of fieldwork and scheduling visits.
- Week Two and Third: Implementation of the instrument in different salmon firms in the sample.
- Fourth Week: Income, coding and processing of field data in SPSS software for further analysis.

Finally, the application of the questionnaire coverage is as follows:

Table 1

Survey Results	
	Total
Achieved	30
Not Met	8
Earrings	3
Rejection	11
Total	52

Source: Own Elaboration

4.2.3. Design of the instrument

- **Dimensions, variables and indicators of the questionnaire**

The two main dimensions linked to a Regional Innovation System approach that we used to prepare the questionnaire and indicators were:

- **Innovation:** understood as the economic implementation of an idea resulting in substantive changes in different areas of the company, whose variables were determined as:

- a) Presence of Innovation
- b) Level and source of access to innovation
- c) Obstacles to innovation

- **Regional Innovation System:** The following variables were established:

- a) Number and characterization of linked companies
- b) Presence of a regional innovation system
- b) The degree of importance given to the presence of a regional innovation system

Then, the different items and features of variables and indicators in the questionnaire are presented:

a) Characterization Company

Indicators:

- Number of Workers
- Percentage of workers with higher education
- Nationality Company
- Object of the Company (Production Company, provider, laboratory, hatchery, eggs or feed mill producer)

b) Dimension: Innovation

Nominal Dummy Variable: Presence of innovation in the company (Yes / No)

Indicators:

- a) Presence of innovation regarding products
- b) Presence of innovation regarding the production processes
- c) Presence of innovation regarding organizational practices of the company
- d) Presence of innovation with respect to competitiveness in the market

c) Dimension: Innovation

Dummy Variable Nominal: Identifying a source of access to innovation (Yes / No)

Indicators:

- a) Internal Supply Company
- b) Source of interaction and collaboration from networks
- c) Source by external human capital
- d) Own sources of trade
- e) Institutional and / or educational Sources

d) Dimension: Regional Innovation System

Ordinal Variable: Level of importance given to a regional system of innovation

Indicators: Rating statements by applying Likert Scale

- (Very Important / moderately important / unimportant)

- a) Keep networking and partnering with companies within the regional salmon industry
- b) Have access to sources of information, dissemination and knowledge within the salmon industry
- c) Having high specialization and knowledge within the regional Salmon industry
- d) Have support (financial, research, training, etc.) from public and private institutions, research centers and / or universities.

e) Dimension: Innovation

Ordinal Variable: Level of importance of various obstacles present for innovation

Indicators: Assessment of statements by applying Likert Scale

(Very Important / moderately important / unimportant)

- a) Lack of funding from external sources
- b) Lack of qualified personnel
- c) Lack of instances where access to information
- d) Difficulty in finding companies to generate collaboration
- e) Lack of entrepreneurship and innovation in the region
- f) Lack of confidence and trust to pursue collaborative project
- g) Lack of support to the regional bodies
- h) Lack of development policies of salmon industry

5. Methodology used in Each Chapter

5.1. Chapter I: Theoretical framework

An extensive revision and discussion of theoretical advances in primary economic activities and methodological approaches to study RIS will be developed in order to permit a better understanding of the Chilean case, complementing and supporting theoretical findings provided by the analysis of primary information obtained by interviews and surveys.

5.2. Chapter II: The Salmon Industry in Chile

The results of this chapter are mainly based on the review and analysis of bibliographical material. The main economic and population indicators of Chile were reviewed in order to contextualize the importance of the salmon industry as an economic activity in the country. Additionally, special emphasis was given to the territorial impact of the Chilean export model (mainly natural resources) and the importance of FDI. Finally, information about the main features of fishery sector in Chile and particularly the salmon industry: production indicators, location, timing of development as an economic activity in Chile and also comparative advantages in Chile for the development of this industry was provided.

5.3. Chapter III: Geography and Innovation of the Salmon Cluster

The results of this chapter are based on the analysis and review of bibliographic material. Moreover, primary data obtained through interviews and surveys of key regional actors was developed was analyzed. Thus, information about the main features of the salmon cluster: economic indicators and industrial production, major regional actors involved in the development of the cluster and its governance structure at the regional level, the spatial organization of the cluster and the characteristics of the production process was provided. Finally, information about innovation efforts that are carried out both by the salmon cluster and Chilean innovation policies was analyzed.

5.4. Chapter IV: Regional Impacts of the Salmon Industry in Los Lagos Region

Secondary information gathered from bibliographic material and also information obtained from interviews of regional actors was used to understand regional impacts of the salmon industry in the region. Information about main impacts of the salmon industry was provided; socioeconomic impacts (e.g. poverty indicators and HDI) and territorial impacts such as the interaction between rural and urban areas and the accelerated growth of cities in the region that are currently acting as strategic centers for the development of the industry.

5.5. Chapter VII: Regional Conditions to Promote Innovation

In order to understand how innovation efforts may be promoted by regional conditions a qualitative methodology was used. Primary information has been collected from 25 open interviews to regional actors and analyzed using content analysis according to a RIS approach that incorporates main elements that have been identified and studied as critical factors to the development of a RIS. The analysis of each element such as market, innovation, firms, proximity, interaction, knowledge creation and diffusion and institutions as well as the relations among all of them, allowed us to have an understanding of the regional innovation and the role played by the salmon industry activity as the main economic engine of regional competitiveness. From all of these elements, some specific variables have been collected and analyzed based on a systemic framework that considers main features and conditions to the generation of a RIS based on the salmon industry economic activity.

5.6. Chapter VI: Salmon Firms and Regional Innovation Systems

The results of this chapter were obtained from primary data collected through a survey of different firms representing the entire spectrum of salmon industry. A quantitative analysis was performed based on descriptive statistics in order to understand how the innovation efforts of firms were favored or hindered by regional conditions.

CHAPTER III: THEORETICAL FRAMEWORK

1. Geography of Innovation

In the context of the “New Economic Geography” approach, the spatial dimension of the economy has been continuously complemented by different inputs. Initial attempts were focused on clarifying the factors that determine the location of economic activities over space. Weber (1909/29) and Lösch (1940/54), for example, conclude that the localization of economic activities was determined by comparative advantages of spatial

competition, and this ultimately had an impact on a specific regional specialization. These works were usually based on the concepts of transportation costs and demand behavior. By contrast, Marshall (1920), Myrdal (1956), Hirschman (1958), and Krugman (1991), have explained the location and economic agglomerations as the result of external economies of geographical areas, stressing the high importance and role played by territorial factors in the understanding of economic performance.

As an effort to find regular patterns and organization structures of the economic activities in space, Vön Thünen and Christaller built the theory of "central place". To these actors the main problems in central place models do not respond to concentration because they do not incorporate microeconomic factors and human behavior to understand it. Therefore this was not a model but rather a classification. The Base-multiplier analysis of Friedman has its origin in the Keynesians ideas and divides regions into two categories linked to their economic activities: one that meets demands outside of the region (base-export) and another that provides goods and services to local residents of a region. This approach put emphasis on macroeconomic settings considering a top - down public policy perspective (Redding, 2011).

The Marxist theory of radical geography has been an important driver in the initial debate considering the special focus on the failures of the capitalist model and their uneven impact of space (Harvey, 1982; Massey, 1984). Based on Keynesian and Marxist concepts, in the mid-eighties economic geography and public policies were structured around two major linked research programs: dynamics of industrial location and differences of regional development. However, recently economic geography has been progressively subjected to criticism; as it is argued by Milton Santos, it is necessary to further progress in the understanding of new economic and political structures of new spatial configurations. The new economic geography is now based on new realities and processes associated with the globalization of the economy and therefore is required to be renewed (Mendez, 1997).

The neoclassical growth theory was mainly characterized by a short-term view of development based on conditions of perfect economic equilibrium. Since economic activity affects economic agents homogenously, they all have the same economic opportunities for growth and hence socioeconomic development convergence is a fact.

This framework was built and based on an economic equilibrium model, where different regulations and policies were seen from a linear perspective stressing the spontaneous regulations of markets and the ultra-liberalization of the market system. This theory has a focus on external macroeconomic aspects of economy growth and at the core of the economic equilibrium there is equality between supply and demand. All variables can be adjusted simultaneously as an effect of market prices (Solow, 1956).

An important conceptual model to understand the improvements of the Solow neoclassical model in which the nature of technology and sources of technical change are omitted (Solow, 1956), is provided for Acs and Audretsch, (1990), through the Marshall-Arrow-Romer model where externalities based on the non-rival feature of knowledge are determinants to the creation of new knowledge regarding technology spillovers and entrepreneurship as basic regional dynamics to promote growth.

The central idea considering the relevance of “socio-economic scale” dilemma is configured to the extent that while globalization tends to uniform ideas, technologies and a global market, the regions and local levels, based on proximity and concentration phenomenon, are seen as the sole levels where market strategies should be developed (Kirat and Lung, 1999).

During the 1990s the role of space was again brought to the center of the economic theory. Walter Isard's (1956) ideas were the base of "regional science" and allowed, three decades after, to set the foundation for a “New Economic Geography” theory that has had a fundamental repercussion on many levels of economic and political decisions (Krugman, 1991). The difference between economic concentration and density was analysed as the result of a set of cumulative processes; they no longer respond only to inherent differences in the locations. The forces of market tend to concentrate investment within areas that can offer better infrastructure, human capital, less risks and better access to the markets (Krugman and Venables, 1990). Agglomeration processes are the result of centrifugal and centripetal forces that promote geography concentration of economic activities (Fujita, et al, 2000).

Endogenous growth theory is a more complex perspective and tries to overcome the reductionism of neoclassical theory. Incorporating a microeconomic perspective of the

firms and consumers, the outcome of endogenous elements in economic systems may explain economic growth (Lucas, 1998, Grossman and Helpman, 1991). Growth is the outcome of technological change (technology improvements from accumulated knowledge) and the intention and decisions by agents to maximize their profits. Romer's model emphasises technology as a non-rivalry and partially excludable good, and assume that stock of human capital determines rates of growth (Romer, 1990). The capacity of technology to spill over between economic actors and over time should be one of the main points sustaining innovation policies (Johansson, *et al*, 2007).

Globalization and new technologies have set new standards in spatial reality linked to flexible production system (Piore and Sabel, 1984). The increasing use of new technologies in firms has also promoted that tacit knowledge becomes codified modifying traditional advantages of localization factors because they become "ubiquities". These ubiquities process gradually augment the competitive advantages of low cost regions, since location factor to firms are based even more on accumulative and useful tacit knowledge and trust among local actors in regions, fostering innovation (Maskell and Malmberg, 1999). As tacit knowledge is generated and diffused easily through local proximity, knowledge of economic activities tends to be concentrated. This means a re-conceptualization of where comparative advantages are located. Firms take benefits from externalities and agglomeration economic activities within an industrial concentration, depending highly on the stage of their life cycle (Audretsch, 1998).

The GREMI School has developed fundamental theory bases to better understand the relation between specific localized external and internal environments to firms and innovation processes through deep analysis of Industrial District and Milieu Innovateur. Based on the Marshall seminal ideas of Industrial District, the agglomeration advantages and the role of endogenous institutions and a common culture that permits complementarities and cooperation between specialized firms to promote innovation have been emphasized (Becattini, 1990). The milieu innovateur theory (Camagni, 1995) is based mainly on the concept of learning and interaction considering that the transfer of accumulated and interactive common knowledge in high technology milieu is based on a collective learning process embedded in the element of "club externality"

understood as a set of social rules that allow individuals to coordinate actions to solve problems (Capello, 1999).

The Californian school has recognized difficulties to unify different patterns of industrialization focusing on conceptual frameworks to identify types of productive activity (scale and scope economies), territorial dimensions and governance structures. It stresses the way of how industrial spaces operate when agglomeration productive systems promote innovation from inter-firm transactions and social interaction, regulations that arise from specific institutions and members of local networks: large and small firms, industry, entrepreneurs, educational institutions, R&D laboratories, members of trade, etc. Many cases have been studied such as Silicon Valley, Southern California, Emilia-Romagna, etc, where they identify regular patterns of inter - firm coordination and cooperation fostered by a government structure based on untraded interdependencies (Storper and Harrison, 1991, Storper, 1995, Scott and Storper, 2003) or Institutional Thickness (Amin and Thirft, 1994).

The evolutionary approach has become an important theoretical tool to understand technological and organizational change (Nelson & Winter, 1982). The focus on the evolutionary growth is based on a long term economic growth that is the result of evolving and dynamic processes. This means that every process of generation of new knowledge is related to a path of dependency. Technological changes should incorporate all of the diverse elements and interactions that made this evolution possible, so that every process has a specific history related to it. The generation of new knowledge is possible through natural innovation drivers such as creation, selection and competition, and takes into account factors like uncertainty to understand the behavior of firms and markets as a response to their evolution. In other words, they will respond based on their dependency path (Johansson, *et al*, 2007).

Evolutionary economists put special focus on the routines of firms and markets, environmental influence and institutions. Firms do not make optimal decisions. The role of tacit knowledge, routines, creativity, sharing information and technologies through a learning process is stressed. Firms are considered as collective organizations with the capacity to learn, especially through interaction with other firms and local actors stressing the socio cultural environments where they are located and embedded (Cooke,

2004). Three specific learning process models of firms can be identified: a) the Science Technology and Innovation (STI), based mostly in analytical knowledge, b) the Doing Using Interaction (DUI) model, dominated by synthetic and symbolic knowledge and c) the Combined and Complex mode of Innovation (CCI) (Isaksen and Karlsen, 2010).

The evolutionary approach has changed the neoclassic geography perspective to a more social, institutional and cultural economic geography approach. It combines deductive and inductive methodological analysis, in which routines of the firms are in the center of a more complex analysis, behavior of the firms is highly related to its path-dependence, and institutions are the main factor influencing innovation, and sectors and networks evolve and conform real places. In general terms; *“Evolutionary Economic Geography does not explain regional growth differences from macro-institutional differences, but from micro-histories of firms that operate in territorial contexts”* (Boschma and Frenken, 2006. pp. 282). In the same context, the concept of related variety has emphasized the differentiated knowledge bases of a particular territory and the diffusion aspect of the knowledge across complementary sectors in order to construct regional advantages, especially considering the importance of diversity in agglomeration economics (Asheim, *et al*, 2007).

2. Regional Development and Innovation Policies

Innovation is an endogenous and crucial factor for regional development derived from the ability of local business to perform and generate incomes. A core element in a non-linear approach to understand economic growth should be focused on regional policies promoting improvements on the ability to obtain knowledge diffusion and management, education, cluster development, research, innovation and new technology, adventure economy, local entrepreneurship and human resources (Cornett, 2009).

Despite the fact that most economic functions in a modern society are fulfilled by the market mechanism and capitalist firms, there is however, a necessity to complement these market and capitalist actors through public intervention by specific policies. The issue is what should be performed by the state or public sector and what should not be. Edquist (2001) argues that the main reasons for public policy interventions are the

failures of the market mechanisms and the ability of the states (national, regional, local) and their public agencies to solve or mitigate the problem. To do this, generating policy instruments and new organizations and institutions to carry out the intervention is mandatory. At a national level, there are two main categories of policies to solve or mitigate these problems: first, the state can use non-market mechanisms and secondly, public actions should create new markets and improve existing markets.

Public Policy initiatives and programs to stimulate economic growth and development have had to consider these current market events in a context of accelerated globalization and rapid changes and have internalized the urgent need to adapt to this reality through strategies that promote environmental competitiveness and innovation. These specific policies have been focused on the support of science and technology, regional policies to support lagging regions reducing regional disparities within the national context and policies directly supporting regional strategic industries (especially linked to support for Small and Medium Enterprises) (OECD, 2007b).

Market failures and main features of scientific knowledge (uncertainty, inappropriability and indivisibility), directly affect the private incentive to invest in R&D. That should be over passed with a research and innovation policy intervention regarding social impacts of a reduced and unequal allocation of scientific investments (Intarakumnerd and Chaminade, 2011, Martin & Scott, 2000).

As a knowledge economy is reinforced (OECD, 2004a, 2007b), productivity is now more focused on factors such as human capital, R&D investments, incorporation and use of TICs and less on the exploitation of natural resources (Cooke, et al, 2007). To the private sector (but also the public sector) it is mandatory to constantly generate innovations or new commercial knowledge in order to generate competitive advantages and satisfy increasing demand of customers. At firm-level it has been demonstrated that process innovations have a greater impact on productivity of the firms and R&D efforts promoting the incorporation of new technologies that also have a positive impact on the firms growth (Parisia, 2006). This fact has stressed a wider non-linear, interactive and open process where firms search and use internal but also external sources of knowledge and information.

In this context, considering the importance of innovation and the spatial component of a knowledge economy, public policy and industrial programs in many countries have had to adapt their policies to this new scenario through strategies that support endogenous firms and promote an environment of competitiveness and innovation. In this setting, as Cooke (2003) argues, advanced economies have promoted regional innovation and cluster policies practically everywhere in order to foster national competitiveness. These policies should be designed considering an analytical perspective and the best practice experiences in other regions. However, policies must be generated locally considering unique cultural conditions of each region; it is impossible to base or imitate a policy entirely on other successful practices.

Other studies have stressed the positive impact of policies that consider the role of mega agglomerations as city-regions and specialized regional economies as an active and causal element in the process of economic growth and development. The relationship between agglomeration, urbanization and development has been demonstrated empirically. According to path-dependencies in city - regions they will be able to attract investment and generate development considering different industrial activities. An extremely liberal economy hampers the transference of untraded interdependencies, competitiveness and productivity factors among regions and reinforces the process of increasing uneven development. However, there are some complementarities between central and peripheral regions as well, that contributes with convergence processes. Policies must focus on the creation of common assets in the region, institutional and organizational foundations and synergies to promote economic growth considering also balanced interventions between agglomerations and lagging regions support (Scott and Storper, 2003).

Malmberg and Maskell (1997), supporting a resource-based view, demonstrate that history and proximity matters acting as a force to develop localized agglomeration of economic activities promote economic growth. Development has an endogenous component; disparities in growth (advanced and lagging regions and countries) can be attributed in part to specific social capabilities related to cultural factors, internal “asset mass efficiency” of firms and external interaction and learning processes embedded in a networked structure of customers, suppliers, competitors and institutions taking advantage of market opportunities.

Many of the current policies at a regional level are related to capital accumulation and skills embodied in the human capital, growth of R&D activity, macroeconomic environment, well developed financial markets, trade and investments. Inflexible regulations hamper the efficiency of product markets and impact negatively on the overall economic growth (Bassanini, *et al*, 2001). Regarding general innovation policy instruments, they should focus on institutions, infrastructure, incentives, education and training policies, on labor and financial market policies and also company related policies (i.e. avoid bureaucracy friction). Specific innovation policy instruments should include innovation systems policies, R&D policies and commercialization policies (e.g. public internet) (Johansson, *et al*, 2007).

3. Innovation policies in Latin America and Social Development

In the last thirty years, Latin American countries have strongly encouraged neoliberal industrial policies that have in general terms been conducive to positive levels of growth but increasingly have augmented disparities and income inequalities (Forbes, 2000). Inequality income, however, depends not only on growth behavior of the countries but on many non-deterministic variables that have to be overcome eventually with redistributive policies (Glaeser, 2005).

According to Metcalfe and Ramlogan (2008), structural initial policies to generate economic growth in Latin American countries such as trade liberalization, inflation, prices or tax policies and the use of low skilled employment to exploit natural resource advantages through transnational companies (TNCs) are not enough in a long-term perspective to increase social development. In this context, an institutional cohesive platform to support innovation is required to generate economic knowledge-based capabilities and increase organizational competitiveness. Therefore, the discussion about innovation systems in developing countries is reasonable (Alcorta and Peres, 1998, Cimoli, 2002) and the question of how science and technology may become the key to increase social and economic development is justified. The answer seems to be related to innovation and learning (Dutrénit and Katz (2005). Viotte (2002) has stressed the importance of learning and the “national learning systems” approach to understand technological change in developing countries.

Niosi (2010) stresses the necessity of developing countries to improve science, technology and innovation (STI) policies and incorporate new dynamic economic sectors to promote economic growth and social development. Those improvements should increase government commitments, policy evaluation and vertical or sectoral STI policies, enhance the efficiency and presence of innovation institutions and policy incentives for R&D in the private sector. However, besides a public policy focused on the incorporation of more dynamic sectors such as technology (clearly absent in developing countries), the necessity to improve the most current competitive low-tech economic sector is also mandatory, especially considering that world competitive economic areas can still be complemented and enhanced resulting in the apparition of new domestic specialized and highly intensive knowledge economic sectors.

The design and implementation of public policies should depend on the innovation features of the region: peripheral regions in developing countries should have focus on diffusion-oriented policies emphasizing adoption more than creation of new technologies, and regions with high innovation activities should have policies focusing on spin-offs and high-tech clusters creation (Pro-Inno Europe, 2003a).

Nauwelaers and Wintjes (2002) propose a change in the rationality and orientation of innovation policies: innovation capabilities demand specific policies and instruments based on differentiated regional settings. This means to generate “policy intelligence” considering the variety of regional contexts, diversity of firms, abilities and attitudes, driving forces and barriers towards innovation in small and medium enterprises (SMEs). A non-linear approach to understand public policies should also be considered as well as a regional dimension of innovation as a learning and interactive process.

In the same context, an important set of literature has emphasized that the justification for innovation policy intervention should be more focused on the features of systemic failures than on the initiatives generated to overcome market failures (Bleda & del Rio, 2013, Dogson, et al, 2010).

4. Innovation Policies and Cluster Approach

Different programs in many countries, at both the national and regional level, have been created to promote the identification, strengthening and creation of specialized regions in productive clusters as a mechanism to deal with the transformations of the world economy and generate regional development (Asheim and Isaksen, 2000, Andersson and Karlsson, 2004, Ketels, *et al*, 2006).

According to Porter, clusters are;

“Geographical concentrations of interconnected companies, specialized suppliers and service providers, firms in related industries, and associated institutions in particular fields (e.g. universities, standard agencies, and trade associations) that compete but also co-operate” (Porter, 1998. p. 197).

European cluster policies present a wide variation in policy design, as essentially the main forces behind these interventions are built around the notion that clusters promote innovation because they stimulate the concentration of expertise and knowledge in a limited geographical area to becoming potential poles of growth, enhance competitiveness through a scale and scope economies facilitating dissemination of knowledge, encourage a culture of learning and contribute to develop a common vision among regional actors to achieve collective goals (Pro-Inno Europe, 2003b). Baptista and Swann (1998) have shown that firms located in regional clusters have more propensities to innovate especially when cluster and firms are specialized in the same economic sector. It has also been demonstrated that growth of firms is faster in clusters, tending to attract more new firms (Baptista and Swann, 1996).

Although Porter’s model has been subjected to many critiques and questions, especially in the policy context (Malmberg and Maskell, 2001, Martin and Sunley, 2003), much evidence shows that at an international, national, local and regional level, programs based on cluster policies have increased in the world; they have been able to adapt to a wide variety of contexts as a complement or specific policy to promote innovation and competitiveness. Specifically, programs that support cluster and regional specialization have originated three different focused policies: a) regional policies, with emphasis on peripheral regions and RIS generation; b) science and technology policies, focused on

collaborative R&D, high-growth industries and new technologies within regions with a basic platform of key firms and agglomeration, and c) industrial policies, with focus on SMEs as a fundamental platform to foster economic growth. Of course, there are cases where these kinds of policies are mixed (OECD, 2007a). However, it is possible to differentiate among these specific initiatives policies that have focused on the external conditions to promote innovation and others that have been centered to encourage internal capabilities to promoting innovation in firms.

Since cluster policies continually used to promote technological change tend to generate regional specialization around a specific economic activity, it is possible to question the capacity of concentrated versus diversified economic activities to promote innovation. Feldman and Audretsch (1999) have provided interesting evidence of the capacity of diversified and complementary economic activities to generate knowledge spillovers fostering innovation performance. Fritsch and Slavtchev (2009) find a positive relationship between industry specialization and RIS efficiency to generate new knowledge. However, there is an inflection point in the curve of specialization where some externalities are initiated reducing regional efficiency. This regional efficiency reduction can only be explained regarding regional specific factors, supporting the idea that “there are no one-size-fits-all policy recommendations”.

There is some consensus in the field of regional development that industrial and institutional features of particular regions and their capacity to generate innovation and knowledge are main factors to increase the performance of regional economies. In this context, the policy concept of smart specialization has stressed the importance of the regional diversity, supporting potential targets for policy intervention, where entrepreneurs discovery and local stakeholders are the main factor to determine the specific economic sectors or clusters that should be promoted (Foray, et al, 2009, Boschma, 2013).

Clusters may evolve from either evolutionary or planning forces. Both forces are bound by history and geography, and therefore every cluster has its own unique characteristics; they tend to develop differently in distinct geographies and time periods. Clusters should be described along four key dimensions: type of agglomeration, level of dynamism and competitiveness, stage in the life cycle, and level of political

involvement (Sölvell, 2009). Iammarino and McCann (2006), while studying the relationship between clusters, location and innovation, provide an important theoretical review to support a classification system of clusters based on transactions costs, relations characteristics and technological knowledge.

The concept of sectoral innovation systems, presents common aspects with the concept of cluster. However, the concept of sectoral innovation system emphasizes the importance of a specific cumulative knowledge base, appropriability conditions and technologies developed for a specific sector or industries in order to satisfy a determined or potential demand of market opportunity (Carlsson, et al, 2002).

Cluster policies cannot be homogeneous because they depend basically on the existing territorial potential and resources that change the objectives and implementation processes accordingly with the particularities of each region. It is possible to describe cluster policies considering specific features such as; level of aggregation, network and collaboration dynamics or degree of international dimension. On the other hand, cluster policies can be designed to strengthen existing 'traditional' clusters or emerging clusters. The role of the government in this practice may differ from clusters supporting a bottom-up process or otherwise a top-down support (Pro-Inno Europe, 2003b).

According to Sölvell (2009), the main policy implication for clusters are; a) science and innovation; clusters are sensitive to investments in science and technology development, b) competition; rivalry is one of the key ingredients of dynamic clusters, c) trade; links to world markets have a fundamental importance to the dynamism of clusters, d) international integration, e) regional; clusters can gain from regional programs, and f) social; regarding the importance of access to efficient public services enhancing their attractiveness and bringing new resources from the outside. In addition, the objectives of cluster initiatives should include: human resources, cluster expansion aiming to increasing the number of firms, business development, commercial cooperation and interaction, innovation objectives and a business environment.

Clusters based on SMEs have been studied in developing countries in the context of determinants to increase competitiveness and collective efficiency. Cluster public policies, besides focusing on inter-firm linkages, should also be centered on a set of

policies improving technological capabilities (human capital, use of external knowledge) improving intermediate financial and technical service institutions, (for example linkages with R&D-intensive services or general support services) infrastructure to business transactions, access to global markets maintaining open trades and reducing specific tariffs to promote export SMEs (Albaladejo, 2001). In the same context, Bortagaray and Tiffin (2004) argues that innovative clusters are crucial to industrial and social development in Latin America. However, since Latin American industries are commonly featured by a strong dependence on export multinationals, reduced presence of technological innovation firms and isolated performance of firms regarding knowledge institutions, protoclusters have not evolve to well-developed innovative clusters. There are important missing areas that have to be overcome: finance, market access, integration of stakeholders (for example private and public collaboration) and local awareness about entrepreneurship, and innovation and support of social and cultural local values.

In the last years interesting research has been provided linking cluster theories with global value chains in developing countries and poverty (Kaplinsky, 2000, Nadvi and Barrientos, 2004) stressing the importance of external sources of knowledge where TNCs may act as a link between clusters and global markets boosting in this process the innovative capacity and interactive learning of local cluster firms, especially SMEs that have to enhance their absorptive capacity (Cohen and Levinthal, 1990) through more skilled human capital to capture, use and transform external knowledge. This issue has become an important element to consider for policymakers in developing countries (Chaminade and Vang, 2006a). Morrison, *et al* (2008), have added in the same context, the positive impact of global value chains and demand to promote innovation and learning processes in developing countries as the result of mandatory and systematic upgrading of technological capabilities of local producers. A special focus in the analysis of global value chains has to consider firm efforts to enhance technological capabilities, dynamics of knowledge flows and governance of the value chains (for example chain leaders). Caniëls and Romijn (2003) argues that policies of regional growth and competitiveness of SMEs should include a meso-level collective efficiency approach and micro-level firm approach of technological capabilities in geographic clusters.

Feser (2002) comments on specific cluster policies that have to be supported in the Latin American context and differences considering theoretical advances in cluster policies and real scenarios to cluster policy implementation. Cluster initiatives have to be supported by a specific conceptual framework of policies considering impacts, evaluation and monitoring, especially regarding lower classic indicators or imputes of innovation (R&D expenditures, patents rates, knowledge oriented firms, educational levels, etc.) and innovative activities more closely linked to process (cost-reduction, managements enhancements, marketing) than product innovations. Feser (2002) regarding industrial policy in Latin America identifies two important phases after the substitution of imports era; the first (80-90's) featured by structural reforms, privatizations, export trade and liberalization regulation and markets and after the 90's until present day where public strategies have been more focused on firms, technology, support of research, educational support, competitiveness, innovation and value chains.

5. Regional Innovation Systems and Developing Countries

Cluster and RIS policies are different. However, since cluster and RIS are closely related, the economic sector has to be considered, specificities of clusters and the high density of functionally related firms. A RIS can extend or contain several sectors in the regional economy; it is only necessary that firms and knowledge organizations interact systematically, therefore, it is possible that clusters or more than one cluster and RIS coexist in the same territory, however, it is not necessary that a cluster be a part of a RIS (Asheim and Coenen, 2004). Andersson and Karlsson (2004) say that clusters can play a key role for a RIS but the existence of regional cluster is not enough for a RIS (Andersson and Karlsson, 2004). Isaksen (2001) in the same way supports the idea that the first pre-requirement for the emergence of RIS are not regional clusters, but regional innovative networks, cooperation and organization activities between firms. Furthermore, regional clusters are seen more as a spontaneous phenomenon while RIS have a more planned and systematic character. In general terms, literature of RIS, industrial districts, and innovative milieu is more aware of evolutionary processes of institutional interaction, social networking and learning process, while cluster approach includes a more static analysis to comprehend regional competitiveness (Asheim, *et al*, 2011).

Innovation systems address the importance of tacit knowledge embedded in people, firms and local cooperation to the development of an interactive learning process (Lundvall, 2007). Some definitions of National Innovation Systems (NIS) support the idea that networks of public and private sectors initiatives at a national level have a major impact on the generation of new knowledge. The interaction and relationships of different elements in a nation allow the creation of new and economically useful knowledge determining the performance of national firms and also affecting the rate and direction of the technological change in society. All of these definitions highlight the importance of interactive learning and the role of nation-based institutions as cornerstones to innovation activities (Edquist and Lundvall, 1993, Freeman, 1987, Lundvall, 1992, Lundvall and Borrás, 1998, Nelson and Rosenberg, 1993). However, in the last years the same authors linked to NIS approach have been also aware of the increasing importance of the regional level to promote innovation.

According to Asheim and Isaksen (2000); *“Policy emphasizes moves towards the support of networks and clusters of firms (that may have a regional, national or even a larger geographical extension), and the stimulation of interactive learning among firms and with knowledge organisations. The shift towards the interactive innovation model has, accordingly, increased the importance of the concepts of national and regional innovation systems in policy design”* (Asheim and Isaksen, 2000. p. 3).

Chung (2002) supports the idea of the formulation and implementation of a national innovation system as a matrix composed by RIS because that would effectively allow the creation of sectarian innovation systems in terms of mapping of innovation actors. These innovation systems should be further developed and promoted by the central government and focus on interactive learning between actors and cooperation between central and regional governments. Park (2001) considers the experience of regional innovation strategies in the knowledge-based economy in Korea since the 1990s and proposes five major policies to promote RIS: promotion of regional clustering, building habitats for innovation and entrepreneurship, collective learning processes and innovation networks, promoting local and global networks and building a stock of social capital.

Innovation systems have been considered as an important instrument to reach economic growth and reduce regional divergence. Complex systems may evolve through a mechanism of new systematic knowledge production, based on the generation of local knowledge and learning process (Hudson, 1999). One of the most significant changes in this matter was the reconsideration of the scale of analysis to understand the economic performance and technological competitiveness. Innovation policies were rethought from a national level toward a regional level. According to Fischer (2006) there isn't a particular reason to prefer a national scale over sub-national scales of innovation systems.

Cooke (2004) argues that: *“Regional innovation system consists of interacting knowledge generation and exploitation sub-systems linked to global, national and other regional systems for commercializing new knowledge”* (Cooke. 2004. p. 3).

Innovation public policy in Latin America is crucial to overcome structural problems of developing countries in terms of competitiveness to generate social development. A strong neoliberal model has to be complemented by specific regional policies. An innovation system approach has become an important policy tool to front most structural economic but also social problems. This policy approach contributes to generate a system composed by a set of actors: firms, organizations and institutions with recurrent patterns of behavior, conventions, values and routines, learning and interacting in order to generate, use and diffuse new and economically useful knowledge in the productive process (Fischer, 2006). Therefore, localized learning is highly related to localized capabilities and localized spatial proximity of similar economic activities enhancing learning processes of the firms (Malmberg and Maskell, 2006).

Cooke (2003) shows that the concept of learning is a central feature in Innovation systems;

“Learning is defined as a collective process shaped by the existing structure of production, by organizations and by institutions. It is assumed that the characteristics of such a learning system are central to questions of growth, employment and competition... Learning... takes place within the production process; therefore it might be called learning by producing, indicating that its basic components may be thought of

as learning by doing, by using and by interacting in relation to normal production activities” (In Cooke, 2003. p.5).

As economic activity is directly related not only to technological innovations but also to knowledge and the learning process, policies should promote at a regional level a new institutional setting and organization forms, promoting innovation and sustainability in the long-term. This means a paradigmatic change giving emphasis on intangible factors such as human resources promotion, overcoming the classical innovation infrastructure promotion (Koschatzky, 2005). Innovation policies should be centered on region unities and have to be based on a set of relations among local actors and organizations generating innovation and facilitating the emergence and adaptation of norms and rules of interaction. A particular intermediating role of the government is suggested as a public intervention, focused on making rules of interaction (Bellandi and Caloffi, 2010). A functional definition of Region is provided by Andersson and Karlsson (2004) as a *“Territory in which the interaction between the market actors and flows of goods and services create a regional economic system whose borders are determined by the point at which the magnitude of these interactions and flows change from one direction to another”* (Andersson and Karlsson, 2004, p.7). Regions must improve their regional resource-base, therefore it is essential to deepen links and interaction between businesses, the knowledge of public sector and also the external environment (Cornett, 2009).

A RIS is built as a base to support a business climate and promote competitiveness at regional level. They have a special local sensibility to incorporate the industrial network in the context of an administrative regional space. The importance of the culture in economic activity performance, coordination and development in three directions has been recognized: 1) Individual level (trust), 2) in a workspace with cultural ability to cooperate and 3) a network based on trust and reciprocity. Therefore, the key to policy makers from a cluster perspective is on the relationships of competition and collaboration (Cooke, 2004). Marshall emphasizes that trust reduces transaction costs in the local production system; there is an industrial atmosphere which facilitates generation and transfer of skills required by local industry, and that promotes the diffusion of innovations among firms (Asheim, *et al*, 2007). Cantner, *et al* (2008), have argued that low tendency to cooperate in RIS is related to the weak performance of

intermediaries and their low levels of complementarity with regional knowledge base. Trust, on the other hand, is the main determinant to failed cooperation projects.

A RIS policy also allows focus on the current industrial strengths of the regions from a systemic view of the firm and the supply side and a more coherent public innovation strategy and inter-regional cooperation (Cooke, 2003).

Asheim and Coenen (2004) sustain that the analysis of RIS must consider two types of knowledge: symbolic, analytical (science based) and synthetic (engineering based), because they mix tacit and codified knowledge. Therefore, skills, organizations and institutions involved in these settings should be considered to differentiate policies and analysis. A knowledge base approach (or specific features of knowledge that are mainly used by a regional competitive industry) can be used to identify industries behavior in different capitalist economies and support specific strategies to the construction of regional advantages (Asheim, 2007).

Considering these conceptual differences provided by Asheim (2007), a particular socio-spatial patterns of innovation based on a Synthetic agro food regional cluster in Canada is provided by Coenen, *et al* (2006) showing the importance of local and non-local collaboration initiatives and the central role of institutions. Knowledge transfer is more common between large companies that generally produce in-house R&D and public research institutions. There is a low degree of appropriability and opportunities to generate innovations and firm-level cumulativeness of knowledge. This biotech agro food cluster also generates an important geographical concentration as a result of natural geographic factors.

In the same context, the most potential and competitive regional industries in Latin American developing countries, are more closed to synthetic knowledge base industries because are mainly related to resource and low-tech industries where an important amount of innovations are the result of previous existing knowledge and the response to solve specific problems or increase efficiency. Spin-offs, R&D initiatives and university-industry collaboration (mostly generated to specific applied research) are quite reduced and innovations are mainly the result of experimentation (learning by doing) and the use of specific know-how.

The knowledge-based perspective of Asheim and Coenen (2004) also has implications on the analytical distinction between clusters and RIS. Clusters based on analytical knowledge tend to be more integrated in the RIS (“integrated cluster-RIS”) than clusters based on Synthetic knowledge (“Auxiliary cluster-RIS”). On the other hand, considering a knowledge base feature of an industry and related institutional structures, Asheim (2007) identifies three types of RIS; a) territorially embedded regional innovation systems where innovations are the result of market demands and inter-firm interaction of mainly synthetic knowledge-based firms, b) regionally networked innovation system based mainly on local interactive learning processes and a strong planned regional institutional infrastructure such as cooperative private and public initiatives and c) a regionalized national innovation system where institutional platform is more integrated to national and international systems and external actors.

Increasingly, many studies have focused on well-developed RIS analyses in very competitive metropolitan areas and core-regions. Andersson and Karlsson (2004) on the contrary put more interest on proposals regarding RIS possibilities in small and medium sized regions with less interaction, cooperation and networks advances and with a mid-developed industrial sector dominated by manufacturing of traditional industries, precarious innovation infrastructure and lack of universities and other regional actors that might collectively promote innovation. Andersson and Karlsson (2004) summarize main points that should be considered in the possibility of a RIS generation in manufacturing small and medium sized regions:

- a) Emergent clustering of manufacturing firms can facilitate interaction and exchange of technical know-how,
- b) Endogenous knowledge should generate considerable learning-by-doing and learning-by-using processes, taking advantage of codified knowledge in a first step,
- c) New knowledge and technical know-how are gradually introduced to the system by diffusion and relocation processes,
- d) Links with other regions help to communicate ideas about how to improve and alter existing products/production processes and finally,
- f) Innovative activities mainly concerned with incremental innovations from imitations and improvements of existing products.

They also propose as a relevant regional policy in these regions to overcome network bottlenecks and promote: contact with relevant research milieu, technical institutions for innovation support, financial support for innovation, young educated people to start in the industry and new subjects in training or technical colleges in the region.

Since RIS in developed countries share basic characteristics with RIS in developing countries, some specific factors and variables of RIS approach can be used to understand a RIS catching-up process, increasing firm and system technical capabilities and linkages with new global knowledge networks (Padilla, *et al*, 2008). In this context, global value chain and external linkages have a key importance to SMEs upgrading Latin American cluster levels (Giuliani, *et al*, 2005). Asheim and Vang (2006), stress the importance of developing an exogenously driven RIS approach as a policy tool and analytical framework to increase sustainable social development in developing countries. In a context of limited and restricted regional knowledge, capital, educational and industrial development level, the authors highlight the crucial role of transnational knowledge sources and embedded transnational corporations in a RIS, the role played by a strong institutional infrastructure and local absorptive capacity to exploit these new external sources of knowledge and upgrade in the global value chain. Absorptive capacity means to increase inter-dependency linkages among regional actors, physical, financial, social capital (trust and cooperative initiatives and interactive learning) and human capital (accessing knowledge spillover of skilled labor force).

Despite that most of the “emerging” RIS in developing countries are highly featured by important weaknesses in terms of fragmented institutional interactions and learning, the positive role played by RIS policy approach supporting the industry transition from competitiveness based on low cost activities to competitiveness based on innovations is underpinned. RIS may become a specialized hub in a global value chain occupying a specific segment in the global market (Chaminade and Vang, 2006b).

Specifically, contributing to initial theoretical findings of RIS policies in developing countries, Intarakumnerd and Chaminade (2011) have stressed that despite some developing countries having officially incorporated the innovation systems policy approach, neoclassical ideas are still behind its practice, as innovation systems are quite weak and fragmented and there are also many difficulties to evaluate implications and

scope of these innovation policies. In this context, they suggest that first innovation policy should be focused on overcoming the neoclassical education of policy makers and initiating innovation systems policies with selected successful projects generating demonstration effects. According to Intarakumnerd and Chaminade (2011) the main systemic problems that should be surpassed in developing countries are related to infrastructure problems (physic, scientific and network), technological transition problems, lock-in problems, soft (routines, values, etc.) and hard (firms, organizations, etc.) institutions problems, networks problems (linkages), capabilities and learning problems.

According to differentiated roles played by RIS in global innovation networks, Chaminade (2011) have identified three marked patterns: a) globalized regional innovation systems (large presence of multinational, SMEs networks, skilled human resources, dense institutional infrastructure), b) interactive regional innovation systems (global integration of large and SMEs firms) and c) localist innovation system (large presence of small firms, reduce research capabilities and interaction based on market transactions).

Isaksen and Karlsen (2010) have stressed regional factors such as educational systems, innovative capability of firms and proactive public and private collaboration efforts in the construction of regional advantages despite the fact that many innovative clusters are increasingly integrated and globally connected through new international markets or the presence of multinationals in clusters.

On the other hand, the constructed regional advantage (CRA) approach (Asheim, *et al*, 2011a) underlines the possibility of turning comparative regional advantages and specific capabilities features of local firms into competitive advantages supported by specific policies in a context of well-developed long-term multi-level governance and proactive public–private cooperation. Regional innovation policy based on the idea of constructing regional advantages should be based on the analysis of related variety (or complementarity spillovers of knowledge among different economic sectors), differentiated knowledge based industries, policy platforms or collective policy agreements and institutional history or intangibles of the region. Regional related variety and a knowledge based approach at the national level have to be considered to

avoid problems that arise from a “*picking the winner*” economic sector. In the same context, entrepreneurial variety can be supported, labor mobility and networks among economic sectors as a long-term innovation regional policy (Asheim, *et al*, 2011b).

6. Regional Innovation Systems, problematic issues

Despite that systemic innovations view through the RIS concept has evolved significantly, there are still unanswered questions about the territorial dimension of innovation, the role of institutions and their emergence and sustainability. The diversity of RIS means confusion about their definition and empirical measurements. The learning process and untraded interdependencies are not enough factors to understand the territorial dimension of these studies. A multidimensional perspective is required to advance in RIS (Doloreux and Parto, 2005). In the same context, Asheim, *et al* (2011c), identifies main topics that remain still not well developed regarding theoretical, policy and empirical advances in RIS approach, specifically considering measurements in the contribution of RIS to regional advantages, the systemic nature of RIS, boundaries of knowledge transfer and learning and also the specific role played by knowledge and learning in the labor market in RIS. In the context of these unanswered questions, the necessity to advance and complement theoretical and empirical research on less successful RIS and traditional industries has been stressed. According to Uyarra (2010), there is still a lack of theoretical clarity considering conceptualization and dynamics of RIS hampering policy adaptation, design and implementation. Iammarino (2005) has argued that the systematic RIS approach has been influenced by a national perspective neglecting regional measurements and statistics indicators, the complexity of the regional multi-level governance system and historical dimension or path dependency of the regions.

It is important to consider that efforts to promote RIS from the public sector can turn them excessively dependent in the same way that the overestimation of forces from the private sector can only be considered in the most advanced development levels, so a balance between public and private governance is emphasized (Cooke, 2003). Some problems are inherent to a capitalist and learning economy. As a capitalist economy has clear structural limits (competition and profits) and economic success is based

increasingly on knowledge and learning processes, both aspects to the possibility of increase social development should be carefully considered. Path-dependency and cumulative causation processes may limit routines and learning capacity only to certain economic settings hampering regional capacity to front new scenarios. On the other hand, an intensive concentration of competitiveness will only favour a few winning regions and an evolved RIS. The critical issue of the “new economy” is the fact that only a few (individuals or region) have the control of knowledge and will try to protect it in order to take advantages from it and increase their profits. Therefore, the existence of learning regions (Morgan, 1997) does not necessarily mean an egalitarian socioeconomic model; on the contrary, it can foster economic and social interregional disparities, as some spaces will be able to learn and win and at the same time many others will lose. These effects cannot be ignored (Hudson, 1999, Boschma, 1999).

When interactions are seen as a critical factor to promote innovation, outputs and impacts of specific public policies applied should consider appropriate ways of evaluation specifically centered on the relational or social effects of interventions. New tools to assess these specific impacts have to be designed considering the difficulties to measure both synergies of networks in an evolutionary perspective and also evaluating related problems with an appropriate unit of analysis (Bellandi and Caloffi, 2010). Tura, *et al*, (2008), sustains that despite the fact that new measures of innovativeness and innovative capabilities have been developed, there are still important problems with evaluation tools of innovation policies. It is a challenge to build regional innovation policy models to evaluate regional innovative network and capabilities.

An important problem is also based on the difficulty to evaluate the outputs of the innovation process. The debate about policy impacts of innovation is highly related to the parameters and conceptual approach to measure it. The traditional understanding of linear innovation processes is a sequential model where the first stage is initiated by: 1.- R&D expenditures or investments, 2.- followed by monitoring inputs, 3.- and outputs (e.g. patents) and finalized by outcomes from previous stages (Noronha Vaz and Nijkamp, 2009). However, innovation is a very complex and chaotic process. Many times reductionist proxies to determine cause-effect mechanisms in innovation are not enough to determine if certain variables are related to inputs or outputs in the innovation

process or if they are linked to other efforts generated between inputs or outputs (Noronha Vaz and Cesário, 2008).

Another aspect that should be considered regarding differences between administrative levels where policies are generated and levels where those interventions are applied (local, regional, national or international level) is discussed by Kuhlmann and Edler (2003). They take into consideration the relationship between the “political systems” and “innovation systems” in Europe to argue that public research, technology and innovation policies are not generated exclusively by national authorities because increasingly, those even compete with regional or transnational innovation policy programs (in particular UE). Duplicity of decisional spheres where innovation policies are elaborated and applied could eventually mean losing resources and impact of policies, confusing local reaction of the target in the intervention program and weakening the general objectives of specific policies.

In a more micro firm level, new organizational processes have meant new characteristics of human resources, as more polyvalent, multi-skilled and empowered workers are now required to increase productivity. However, in a context of extreme discipline and unemployment, those new forms of works intensify the exploitation, auto control, discipline and labor processes, increasing an asymmetric form of power between capital and work, promoting a disempowered subordinate situation and generating precarious forms of work (Hudson, 1999).

7. Interaction Policies to Innovation, Proximity and Networks

Based on the analysis of existing instruments promoting innovation capabilities of SMEs in European countries and considering innovation as a complex, interactive and non-linear learning process, Asheim and Isaksen (2000) propose that RIS should support; a) instruments focusing on behavioral aspects instead of traditional direct support schemes, b) proactive working methods, (c) instruments targeting bottlenecks in regional production and innovation system, (d) all-round instruments (or group of instruments), and (e) adaptation of instruments and policy systems according to different types of SMEs and regional circumstances.

When an innovation system approach is adopted into public policy, instruments and specific actions have to consider asymmetric information, path-dependence, interactive process among system organizations and institutions, and a collective process of creation and knowledge distribution as the result of evolutionary processes. Specific system problems in the system may guide as a policy interventions opportunity to overcome main bottlenecks and also act as a complement to market system failures. Main system problems are related to infrastructure, technological transition problems, lock-in process, hard and soft institutional problems, network problems and capability-learning problems (Chaminade and Edquist, 2006). In this context, despite innovation policies can be a complement to reduce bottlenecks of market failures, the focus of intervention policies should consider territorial particularities and problems related to specific system failures (Klein, et al, 2005).

Regarding an evolutionary approach to explain technological change, despite the fact that technology and the revolution of information and globalization provide a better access to codified knowledge, the critical importance of tacit knowledge and routines to innovation in localized firms has been recently highlighted (Nonaka and Takeuchi, 1995, Gertler, 2003). Regarding the central importance of knowledge and interaction to generate innovations, Nonaka and Takeuchi (1995), identify different stages where tacit knowledge becomes explicit and thus codified, and in this process knowledge has to be first externalized in order to be after socialized, then knowledge is internalized and learned by individuals becoming tacit once again.

Likewise in order to comprehend how tacit knowledge can be produced, founded and how it is shared and applied in a region with a specific social context, the difference between knowledge and information and its relevance to the learning processes, knowledge management and innovation in firms has been stressed (Howells, 2002, Gertler, 2003)

In a knowledge based economy, the innovation model is an interactive process that stresses cooperation between firms and institutions and enhances the role played by dynamic formal and informal networks based on tacit knowledge involving different organizations. Firms in a horizontal and vertical network can cooperate in order to have rapid access to technologies and markets, allowing them to take advantage of external

sources of know-how and know-who, to share risks, flexibility, and trust-based relationships and so on (Fischer, 2006).

Cooperation is seen as a mechanism to transmit information through the different stages of a productive process and is the result of complementarities among firms in an increasingly functional division of labor and firm specialization settings (Antonelli, 1995). In this context, Antonelli (2000) has also stressed the importance of local effective multichannel communication systems within industrial districts in order to capture collective external technological knowledge.

It is also important to emphasize that despite the fact that proximity in networks can be a facilitator of knowledge diffusion and interaction, distance can be relativized taking into consideration the positive outputs of linkages and exchanges that might be harvested between one specific space with other areas where there is a high concentration of knowledge through “Global Pipelines” (Bathelt, *et al*, 2004). Rallet and Torre (1999) have underpinned the importance of geographical proximity as a key factor to generate knowledge diffusion by face to face interaction boosting innovative local networks. However, the lack of geographical proximity could also be provided by organizational proximity and TICs incorporation. In fact, Bochma (2005), have added that geographical proximity cannot be assessed in isolation. In this context, he identified 5 dimension of proximity that strengthening interactive learning; cognitive, organizational, social, institutional and geographical proximity. The cognitive proximity facilitates an effective communication among actors because they share a common knowledge base and expertise, improving thus the process to learn from each other. The organizational proximity is related to with the capacity to coordinate and organize complementary knowledge that is owned by different actors. The social proximity contributes with innovation process because trust and experience contributes with the process of diffusion of tacit knowledge when agents are socially embedded. Finally, institutional proximity facilitates interactive learning processes and coordination because economic actors share the same institutional rules and set of cultural habits and values.

In the same context, Baptista (2000) provides empirical evidence in the context of differences in knowledge diffusion stressing the importance of externalities and

geographical proximity at regional level to the adoption of new technologies by early users.

Networks can be understood as an evolutionary system of mutual dependence based on relational formal and informal resources produced by interactions, processes, procedures and institutionalization (Tijssen, 1998). Networks of individuals and institutions undertake the support of activities, preference and reciprocity. The importance of networks to innovation addresses the idea of considering these dimensions through policies based on innovation systems (Fischer, 2006).

Regarding an evolutionary approach, social network analysis in the context of economic geography and RIS has become an interesting empirical method to investigate the construction and evolution of dynamic patterns and structures of systematic interactions, the identification and mapping of weak and strong linkages among regional actors and knowledge flows in open regional networks (Ter Wal and Boschma, 2009).

Relational data has become the main input to analyse and model structures of knowledge flows (Maggioni and Uberti, 2011). Fritsch and Kauffeld-Monz (2010) applying social network analyses have showed the positive effects of information and knowledge transfer when regional actors are strongly tied in innovative networks. Since innovative networks are based on direct relations among specific organizations, the transference of knowledge and information will be highly related to the specific nature of this knowledge and other factors such as geographic, cognitive, and technological proximity as well as the specific motivation of interactions. Giuliani and Bella (2005), by using social networks analysis, have also studied the influence of cognitive characteristics and a firm's absorptive capacity on inter and extra cluster connections of the knowledge system, identifying cognitive roles played by specific actors in the Chilean wine cluster. Firms with higher absorptive capacity occupied central networks and node positions in the process of knowledge diffusion acting as technological gatekeepers and positively affecting the learning processes and competitiveness of the cluster through intense local and global knowledge connections.

As it is possible to identify nodes or peripheral roles played by specific actors within a region, it is also possible to map the position of regions regarding innovative networks

in a national or international context and main regional factors that contribute to reaching central positions in this network (Bergman and Maier, 2009).

Recently, Moulaert and Mehmood (2010) from the analysis of regional development policies and new regionalism approach (Industrial districts, Innovation Systems, Milieu Innovateur, etc.) incorporate the “black box” of institutional dynamics into the analysis of regional development. They stress that it is necessary to have a new approach based on “sociology of knowledge perspective”, meaning a new interpretation of economic policies from a network theoretical approach with a full cognizance of structural-institutional and cultural dimensions of strategies.

Storper and Venables (2004) have recognized the importance of face to face contacts as a key factor to increase knowledge socialization, communication, philological motivation and work as an incentive to solve specific problems. Asheim, *et al*, (2007) adds to this argument that face to face contacts in urban economies (the transmission of complex tacit knowledge) and buzz (the exchange of group-based information) are the main features of proximity and interaction for agglomeration clusters, showing also the necessity of taking into an account outsourcing, off-shoring, FDIs and considering the type of industries (analytical, synthetic or creative) where face to face contact and buzz interactions are produced.

Power and Malmberg (2005) have relativized the importance of localized economic as a main factor of innovative capacity and learning, arguing that it is more important the openness and external linkages of economic agglomerations and firms than locally integrated regional systems. In this context, further research and public policies should also be centered on the capacity of firms to capture knowledge outside of the regions and generate external market and non-market networks. In the same context, it has been shown that despite some peripheral regions having a systematic lack of clustered features to generate innovation (reduced R&D expenditures, collaboration initiative or geographic proximity), they overcome peripheral regional features supporting their innovative capacity by organizational and cognitive proximity, institutional arrangements and strong linkages and cooperation with international networks (Fitjar and Andrés Rodríguez-Pose, 2011).

It is necessary in those settings that regional developers are able to influence and participate actively in the operational environment of firms, in order to anticipate and determine firms' needs for innovation and networking, allowing the development of micro-level policies and the promotion of external support to fulfill those firms' needs (Kirsi, 2010). In recent years the impact of governance has been seen as a fundamental factor to strengthen productive systems in a long term, contributing to the selection of coordinated forms of cooperative patterns in related firms and environments (Noronha Vaz, et al, 2004).

Despite the fact that many authors recognize that regional public policies are the best unit where policies should be promoted, Tödting and Trippel (2005) sustain that there is not an ideal model for innovation policies because it is necessary to consider first the kind of industry that specific policies are promoting: central, peripheral or old industries are preconditions to generate a specific policy characterized by networking and innovations barriers. Innovation policies based on a lineal model have focused on traditional financial innovation support, R&D infrastructure provision and technologic transfer, neglecting especially the absorb capacity, behavioral characteristics and organizational deficits of the firms and an isolated view of the regions, ignoring also interrelationships with other regions and other spatial levels, national or international.

In today's world, societies are demanding new forms of governance capable of promoting innovation. This means a possible restructuring and reforming of public organizations to improve their contribution to social and economic problems (OECD, 2004a). While Global corporations are coordinated at a globalized economic level, their decisions to invest will be determined by regions with competitive advantages to promote innovation (Cooke, *et al*, 2007).

According to Tödting and Trippel (2005) a new policy model to foster innovation at the regional level should focus on high-tech, knowledge based or creative industries, building research excellence, the attraction of global companies and the stimulation of spin-offs. In the context of RIS, networks and SMEs supported by specific regional innovation policy should play a central role as innovation drivers (Tödting and Kaufmann, 2002).

One of the main problems considered in evolutionary policies is related to path dependencies, meaning that cooperation relationships or networks between actors within a region are unlikely to respond to certain demands and specific necessities of the market when there are strict rules, institutional memory or collaborative expressions that convert the region into an inflexible system. These mechanical routines work as an obstacle to the creativity and innovation processes and do not permit commercialization of new knowledge to solve problems (Cooke, *et al*, 2007). In the same context, absorptive capacity (“*the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends*”, Cohen and Levinthal, 1990, pp. 1) and the correlative capability to generate innovation is highly path-dependent, because it is related to the particular previous background of particular accumulated knowledge of organizations, expertise and investment in R&D. When this specialized knowledge is reduced in an organization, its possibilities to generate innovation will be lower (Cohen and Levinthal, 1990). Abreu, *et al*, (2008) have noted regarding different industries, that regions with high absorptive capacity (based on R&D, use of management techniques and collaboration behavior) increased their innovative performance.

8. Knowledge Spillovers and Innovation

A large part of the qualitative literature on agglomerations such as high-tech clusters and Industrial Districts try to understand the mechanisms through which knowledge flows locally (Breschi and Lissoni, 2001a). Breschi and Lissoni (2001b) summarize those initiative studies as an effort to understand this process considering the role of non-market-based social ties with special emphasis on interpreting knowledge flows as spillovers (pure externalities) and spatial proximity that facilitates the transfer of knowledge through market-based channels, interactions and trust-building activities. Pecuniary externalities may also arise, but these cannot be described as originating a local public good. The direct or indirect transfer of novel knowledge that is received by a firm is a crucial input to generate innovations and increase competitiveness (Gilbert, *et al*, 2008). Besides, a knowledge spillover process should also consider the capacity to capture, absorb, learn, assimilate and use free knowledge (Fischer, 2006). Special

interest in this context is related to the absorptive capacity of firms to internalize external knowledge and generate innovations (Nieto and Quevedo, 2005).

Localized knowledge spillovers have been studied as a key factor for the clustering of innovative firms because the transmission of new knowledge occurs more efficiently among closely located actors. Learning through networking and by interaction is seen as a crucial force pulling to firms and an essential ingredient for the success of innovative clusters (Breschi and Malerba 2005). Gilbert, *et al*, (2008) show that ventures founded in locations with a high concentration of industries have higher product innovation and sales growth than ventures founded in locations with limited industry clustering. The results also confirm that technological spillovers are positively and significantly related to product innovation. In the context of agglomerated economic activities, Alvarez and López (2008) stress the positive horizontal knowledge spillovers from export activity among foreign and domestic exporting plants improving the productivity of local suppliers.

There are important studies trying to measure the impact of externalities from local knowledge spillovers using a knowledge production function approach. Despite the use of the knowledge production function was primarily used for Griliches (1979), using the firm as a unit of analysis, Jaffe (1989), was the first attempt to demonstrate that knowledge tends to spill over within specific geographical boundaries, incorporating in the analysis, the spatial dimension of the externalities (Audretsch & Feldman, 2004).

In the knowledge production function, many different variables are incorporated as independent variables. Regarding university and knowledge diffusion, some research has studied spillovers from R&D and the relationship with the firm size and their life cycle (Acs, *et al*, 1994), the effects of knowledge spillover on academic research (Acs, *et al*, 1992), the existence of some localized technological spillovers from academic institutions into the local business realm (Jaffe, 1989). Audretsch, *et al* (2005a) studying the location choices of new and technological firms to have access to knowledge spillovers from universities, identify different mechanisms (scientific research, human capital) through which those firms capture positive benefits of this proximity fostering innovation. Audretsch, *et al* (2010a) have also pointed that university spillovers but also regional competitiveness are important factors to generate innovation in entrepreneurial

firms. The localization of a new university has a positive impact on the levels of new knowledge-based entrepreneur firm formation (Baptista, *et al*, 2011). In the same context, prior local knowledge and human capital influence the formation of new knowledge based firms in a region (Baptista and Mendonça, 2010). Monjon and Waelbroeck (2003) have noted that knowledge spillovers through formal collaborative research and informal interaction between universities and firms have positive effects on innovation.

In general terms, most of the empirical results have demonstrated the close relationship between proximity and knowledge spillovers and the positive impact on innovation. Knowledge spillovers from technological activities in a local industry positively influence innovating activities in the same sector and contiguous areas, underpinning the importance of proximity (Paci and Usai, 2000). Rodríguez-Pose and Crescenzi (2008), in order to explain regional growth differences, have linked Regional Innovation Systems, knowledge spillovers and R&D investments concluding that innovation capacity of regions highly depends on regional institutional conditions, interaction between local and external research and proximity to the transmission of knowledge.

On the other hand, there are different studies trying to measure local knowledge spillovers from other kinds of methodological techniques (mathematical models and complex statistics), but while the methods used to measure local knowledge spillovers are different, variables measured are in general the same ones: patents, labor mobility, Spin-offs, formal and informal interactions.

Some of those studies are related specifically to the propensity of the scientists to commercialize their research contributing to the knowledge spillover (Audretsch and Aldridge, 2009), in order to analyse patent families and patents that refer or cite each other and indicate the flows of knowledge from one invention to another (Jaffe, *et al*, 1993), and to demonstrate that firms located in agglomerated regions tend to produce a higher number of new products than firms located in more peripheral regions (Brouwer, *et al*, 1999).

It has been also noted that firm location choices underpin the importance of proximity for knowledge spillovers (Alcácer and Chung, 2007), stressing the importance of trust

in buyer–supplier relations and the inflow of knowledge from trading partners (Bönte, 2008). It was shown empirically that knowledge exchanged between local firms and universities does involve market transactions (Zucker, *et al*, 1998) adding internalized market elements in the diffusion of knowledge.

Sectarian and spatial knowledge spillover effects are considered to be major motivating forces for regional concentration patterns of high-technology industries (Tsai 2005). Besides, the importance of creativity, the skills and knowledge embodied in individuals are the mechanisms by which spillovers actually occur (Knudsen, *et al*, 2008). Local knowledge spillovers have a significantly positive impact on firms' innovation performance through labor mobility, company spin-offs, and informal interactions among actors (Kesidou and Romijn, 2008): scientists working in knowledge clusters should tend to be more productive than their counterparts who are geographically isolated (Audretsch and Aldrige, 2009). Feldman and Kelley (2006) have stressed in this context the importance of the role of governments to support public policies boosting knowledge spillovers.

Initiatives to measure knowledge spillovers in a networking context have been introduced to understand the impact of knowledge diffusion in collaborative knowledge creation as an important input for firms to gain new competitive advantages (Ding and Huang, 2010): participation in local business networks does support firm employment growth (Boshuizen, *et al*, 2009), interpersonal networks are important as well in determining observed patterns of knowledge diffusion (Singh, 2005), and also other studies focused upon the role of entrepreneurial firms in the exploration of new technological spaces and the diffusion of accumulated knowledge through local small firm networks (Almeida and Kogut, 2004).

Despite much attention that has been given to the study of knowledge spillovers in developed countries and core-regions, recent research has been focused on the effects of local knowledge spillovers in firms in developing countries. Regarding absorptive capacity of firms and differences between pure knowledge spillovers and commercial knowledge transactions, the study of Kesidou and Szirmai (2008) in Uruguay provides evidence supporting the central importance of knowledge spillovers to increase

innovative performance of software firms and international knowledge transactions to reach economic success.

9. International Knowledge Spillovers

Besides those studies linked to efforts to measure local knowledge spillovers, other initiatives are related to the study of international knowledge spillovers that commonly take into account foreign investments and trade (Grossman and Helpman, 1991, Branstetter 2006), imports and exports of goods and services as variables of knowledge spillovers impacting the economy performance and innovation of countries and regions. An important body of literature has verified the positive effects of FDI by multinationals (affiliates) in the economic growth generating employment, new capital, competition, markets, and capabilities. Some of the advantages of multinationals (superior technology, patents, management and marketing strategies, etc.) cannot be totally internalized by affiliate firms spilling over local firms (Crespo and Fontoura, 2007).

In this context, host countries have had to increase efforts attracting new FDI in order to capture technological innovations that are embedded in multinationals and diffused to local firms increasing local productivity (Ben Hamida and Gugler, 2009).

Although the existence of international spillovers has been empirically demonstrated, Alvarez and Molero (2005) stress the relevance of considering the benefits of FDI in a host country while also taking into account specific technological contents of this external knowledge and technological gaps between capabilities of foreign versus local firms, especially in less developing countries. Cincera and van Pottelsberghe de la Potterie (2001) underpin the necessity to also consider micro determinants such as the transmission mechanism of knowledge in the process of knowledge spillovers through foreign R&D and methodological difficulties to separate rent spillovers from knowledge spillovers. Falvey, *et al.*, (2004), show the existence of spillovers through imports, with consistently significant growth-enhancing effects. Lee, (2006) has demonstrated the existence of knowledge spillovers through FDI inwards and disembodied direct channels. Branstetter (2000), stresses the importance of networks, analysing FDI as a

significant channel for knowledge spillovers among foreign investing firms and indigenous firms.

Other studies have shown evidence of significant spillovers from foreign R&D increasing domestic productivity (Coe and Helpman, 1995). Lööf (2008) provides empirical evidence of knowledge spillovers from domestic and foreign R&D collaboration to Multinational firms. Ben Hamida and Gugler (2009) focusing in the demonstration-related spillovers from FDI show that this process is highly dependent on technological gaps and investments in the absorptive capacity of the firms to assimilate foreign technologies. Thus, specifically comparing evidence of knowledge spillovers in developed and developing countries, results may differ. Some factors such as sectoral activities that in developing countries are more related to low technological economic activities may capture more benefits from systematic knowledge spillovers regarding specific channels such as labor mobility and assistance than effects from interaction mechanisms and technological demonstration, imitation and competition, which are more common factors in high technological sectors. Local firms may incorporate previous workers in multinationals with specific know-how contributing to the diffusing of specific knowledge. On the other hand, firms also need to increase productivity when new competition appears and they have to equilibrate technological capabilities and product and process innovations compared to foreign firms (Ben Hamida and Gugler, 2009). Crespo and Fontoura (2007) have summarized main channels of technological diffusion regarding FDI knowledge spillovers: demonstration and imitation, labor mobility, exports, competition and market linkages with domestic firms. On the other hand they have organized the main factors that determine the existence of these channels: absorptive and technological capacity, regional effects, domestic firms characteristics and FDI characteristics.

It has been also noted that the positive effects of international labor mobility across countries regarding returnee entrepreneurs increase innovation in local firms (Filatotcheva, *et al*, 2011).

The presence of FDI in developing countries and peripheral regions can be a positive linkage for local clusters to have access to global markets. Evidence shows that multinationals are induced to generate FDI to gain access to knowledge in specific areas

but also to have access to exploit natural resources. In addition, joint ventures and acquisition of local firms' by multinationals have become a commercial strategy to secure local presence, reorganize evolutionary processes of local spaces and diffuse specific knowledge by routines, operational practices, procedures, etc., in commercial and non-commercial local networks (Biggiero, 2002). Mulenga (2006), in the context of FDI knowledge spillovers in Zambia, shows important evidence of positive technological spillovers from foreign firms through backward inter-industry linkages. Some foreign firms in Zambia diffuse specific knowledge to local firms in order to enable them to produce more efficiently and provide intermediary inputs.

However, it has been also stressed that in order to exploit the external knowledge that is spilled over through international technological leaders in lagging countries, it is necessary to take into account the domestic absorptive capacity of firms to capture and transform this knowledge to increase innovation and productivity (Mancusi, 2008).

According to Alvarez and Molero (2005), in the context of positive effects of FDI in terms of knowledge spillovers, innovation policies should attempt to increase the attractiveness of host countries (infrastructure and technological facilities).

In the context of a RIS approach, positive impacts of transnational companies (TNCs) in developing countries will depend on the regional capacity to force local development commitments of TNCs and regional government autonomy or decentralized power to make decisions. This impact will also depend on local firm capacity, regional ability to boost linkages and interactive learning processes between TNCs and local firms, the capacity to provide hard infrastructure (such as service platform and competence of local training) and strong regional institutions (Asheim and Vang, 2006).

10. Entrepreneurship and Innovation

Since the creation of firms through entrepreneur initiatives means a new combination of resources at an economic level, new products or services, industrial organization and markets, the bases of the concepts of entrepreneurship and innovation have considered seminar works of Schumpeter where the relationship between both concepts is stressed.

Therefore, entrepreneurs are innovation agents because they are able to create new resource combinations through a “destruction creation” process, constantly destroying old economic structures and incessantly creating a new one. The innovator role of entrepreneurs in big firms is also considered as a fundamental part of the internal innovation process through R&D activities (Schumpeter, 1912/34, 1950).

In recent years, the efforts linked to economic development have focused mainly on the generation of public policies and strategies to promote development at both national and regional levels, stimulating an environment for competitiveness and innovation that encourages entrepreneurship and business productivity, stimulates economic growth and creates jobs in the long term (Acs and Varga, 2005). An elevated rate of firm creation and support is an essential and central issue in public policies in modern countries.

Entrepreneurship has been considered as the key mechanism that makes possible the spillover of new commercial knowledge in a society, becoming a cornerstone of economic technological change, economic growth and social development (Acs, *et al*, 2009). Baptista, *et al*, (2008) in this context, has empirically demonstrated the positive indirect impacts of new business formation on regional employment in a period of 8 years.

Entrepreneurship in developing countries has been a focus of attention since new business formation may become an important tool for generating employment and growth, reducing poverty levels and acting as a base factor of social mobility. Lingelbach, *et al* (2005) regarding differences between entrepreneurship in developed and developing countries have stressed that particular attention should be focused on new growth-oriented enterprises in developing countries and less on microenterprises or long-established SMEs when an entrepreneur policy approach is suggested. In the same sense, opportunity, financial resources and human resources are highlighted.

Different factors may be related to the nature of more reduced opportunities for entrepreneurship in developing countries (regarding differences provided by the Global Entrepreneurship Monitor (GEM): entrepreneurship that is initiated by commercial opportunities or by necessity, that are of course more important in developing countries). Acs and Virgill (2009) have noted in developing countries the negative

impact over entrepreneur action capacity and learning as the result of state interventions and market distortion in monopolist economic phases of colonialism, import substitution and exportation industrial policy. The gap that resulted from the lack of new domestic firms in developing countries was mainly filled in the exportation phase by international firms (through FDI) that had the internal conditions to exploit these new market opportunities through the generation of economies of scale concentrating entrepreneur efforts. Current entrepreneur policies in developing countries have recognized the importance of informal sector and familiar entrepreneurship and also the importance of a positive business environment to new firms creation and SMEs, reducing entrance barriers, promoting demonstration and learning externalities, and improving human capital and firm participation in networks.

According to Landström, *et al* (2008), innovation policies should be thought considering the life cycle of firms. First, entrepreneurial policies should consider initial phases of the firm: pre-start, nascent phase and start-up period, and second, SME policies must be built as a support to the post start up, maintenance and expansion stages. Considering strategic axes of entrepreneurial policies, interventions should consider start up creation, initial firm growth, entrepreneurial education and they should also attempt to reduce barriers to entrance. On the other hand, innovation policies should be complementary to entrepreneurial policies focusing on R&D investment, supply of risk capital and knowledge capabilities, collaborative innovative activities and development and diffusion of science and new technologies. However, in the same context, some authors have argued that public policies based on tangible infrastructure to entrepreneurship such as legal systems and risk capital may fail if they are not complemented with “*intangibles of entrepreneurship*” such as good access to novel ideas, informal forums or executive leadership (Venkataraman, 2004).

One of the fundamental aspects of innovation is related to entrepreneurship and creativity policies at the regional level (Scott, 2006). Modern concepts and policies to support them should be considered in a systemic way, supporting policies that both reward entrepreneurship and value the culture of risk, minimizing stigmatization of failed projects of entrepreneur initiatives to capture market opportunities. Last theoretical efforts have stressed the importance of knowledge diversity of people in the regions to the new business formation. A regional environment featured by an important

cultural diversity and high levels of knowledge, increasing opportunities for start-ups at the regional level (Audretsch, 2010b).

11. Innovation in Low- tech industries

Important efforts have been developed in order to identify and classify patterns of innovation behavior in different sectors and industries. A well-known and used model has been proposed by Hatzichronoglou (1997) from OECD, which classifies countries' industrial sectors by level of technology based on the variable expenditures in R&D to generate value added in products and services. According to this classification industries are divided into: a) high-technology, b) medium-high-technology, c) medium-low-technology and d) low-technology. Particularly, low tech classification encompasses innovation in industries such as paper printing, textiles and clothing, food, beverages, tobacco, wood and furniture. In this low-technology industry, only less than 0.9% corresponds to expenditures in R&D (OECD, 1994). Regarding Pavitt's (1984) taxonomy of industrial sectors, low-tech industry would correspond with "supplier dominated" classification where technological change is mostly provided by suppliers in other sectors. Low-tech industries has been continually neglected by innovation public policies and research despite that they are decisive to regional innovation performance (Bender, 2004, Christensen, 2010).

However, it is important to take into account methodological problems to classify industries based on innovation performances due to methodological problems to measure innovation. Since innovation encompasses complex variables, and is an interactive and non-linear process, the only use of R&D expenditures factors could be quite limited and reductionist to classify and understand innovation behavior and patterns.

The importance of low-tech industries in GDP contribution and employment in developed countries is unquestionable, but is even more important in developing countries (Bender, 2006, Hirsch-Kreinse, 2008, Tunzelmann and Acha, 2005, Christensen, 2010). One of the most important projects related to research in Policy Innovation in low tech industry (PILOT) have concluded that growth and employment

in OECD countries come mainly from low tech industries and are important sources of innovation in the economy. PILOT has also concluded that innovation performance of firms in low tech industries are highly based on organization practices and knowledge management, market and social networks, worker capabilities and inter industry relationships at regional levels (Bender, 2006). In the same context, Palmberg (2002) stresses the importance of collective absorptive capability and collaborative efforts of innovative low tech firms in spite of the absence of R&D initiatives. Garibaldo and Jacobson (2005) have highlighted the importance of firm embedness in social networks to generate innovations and increase competitiveness to upgrade managerial capacities.

Hirsch-Kreinse (2008) identifies three typical patterns of innovative low and medium tech companies. Standard industries that produce easily imitable products generally improve changing individual materials, functions or qualities of their product process but the technological bases of products are maintained. Other service oriented companies attempt to generate innovation to gain new markets, initiating functional and technical improvements of products. Finally, there are also other companies making efforts to gain competitiveness based only on process innovations.

Bender (2004) in this context, has noted that many innovations are not science-based, stressing the importance of incremental versus radical innovation in low tech firms that are commonly neglected considering their low degree of novelty and different impacts on firm competitiveness. In this sense, innovation practices in low-tech industries would be mainly featured by specific managerial and commercial routines. Particular patterns can be identified in low tech innovation behavior. Considering specific drivers of innovations, they are commonly the result of market demand or specific regulatory requirements. Evidence also shows that innovation in low tech industries is increasingly based more on knowledge intensive processes. In this context, the capacity to search, identify and proof knowledge (Tunzelmann, von and Acha, 2005) is crucial in this industry as well as the internal firm's ability to internalize, synthesize and recombine this knowledge (Bender, 2004).

According to Hirsch-Kreinse (2008), preconditions of firm innovativeness in low tech industries are linked to 1) knowledge base factors or the capacity to acquire practical and functional knowledge in learning (by doing and using) processes to solve specific

problems, 2) knowledge carrier and dissemination of innovations (mostly process innovations) that generally are the result of operative processes and are spread by technical or professional staff; external sources of knowledge should be also considered to incorporate new knowledge and also as dissemination agents such as suppliers or services, 3) Innovative capability or the accumulated previous knowledge to use, recombine and integrate new knowledge, and 4) networks and links intensity with high tech industry.

Based on the specificities of low-tech industry such as innovative capabilities and development perspectives, specific innovation policies should also be considered in order to overcome the increasing focus on and the current limited perspective of high tech policies (Hirsch-Kreinse, 2008).

Despite the fact that most research has focused on the contradiction between the importance of low-tech industries in high-tech countries, low-tech industries still can be considered and studied as a base platform activity for developing countries, especially when low-tech industries generate specialized and competitive clusters that become development poles in lagging regions.

Despite low tech clusters may possibly have important global connections, local conditions are still crucial when low-tech resource based-industries depend mostly on natural conditions. Regional concentrations of these activities are in this context rather frequent, but this does not necessarily mean the conformation of a competitive cluster, nor the capacity to generate a competitive industry based on scale or scope economies. That will depend on the attractiveness of local conditions and the capacity to competitively and sustainably exploit a natural resource.

Christensen (2010) considers the importance of low-tech cluster conformation to increase comparative advantages and specialization. Despite innovation in this kind of clusters are quite organizational and knowledge commonly comes from outside the region, local cooperative, networks, informal knowledge sharing, educational and governance factors are fundamental to generate process and product innovations increasing competitiveness of the industry. The production process may be enhanced by observing and benchmarking the best practices. Garibaldo and Jacobson (2005) have

noted that social cohesion, local governance marked by a collective decision process and a strong institution infrastructure generate social environments that positively affect the innovation behavior of low tech firms.

There are some parts of the value chain that should incorporate specialized scientific knowledge; the interaction between low and high tech industries in this context is higher and the boundaries between both industries are fuzzy. Mendonça and von Tunzelmann (2004) argue that the “old economy” (related to low-tech industry) has evolved to the “new economy” because it has increasingly incorporated, combined and accumulated diversified technologies and learning capabilities (ICT or biotechnology) complementing the production process according to the development of specific economic activities, becoming key players in social development.

An important regional policy can be based on the promotion of knowledge intense entrepreneurs in low tech industry. Common problems such as path dependence to the generation of those kind of entrepreneurs in this low tech industry may also become an important trigger to the generation of new ideas increasing regional growth and development (Hirsch-Kreinsen and Schwinge, 2011).

12. Conclusions from the Theoretical Framework

The RIS literature reviewed aims to define the theoretical framework and key concepts that will be used for the analysis of this thesis. We carried out a detailed analysis of main research advances related to different variables and concepts which commonly contain a RIS analysis. In the context of a knowledge-based economy, it was developed a review of the main components that explain regional development, the importance of innovation, proximity, the regional use of knowledge spillovers, the importance of interaction and collaboration between regional actors and the way innovation policy can improve particular failures of a unique production system.

There were analyzed main theoretical advances that have consolidated the new economic geography and main factors that have been studied to analyze the spatial dimension of the economy. In this context, externalities and institutions have played an

important role for the location of firms in specific geographic areas, allowing the increment of the productivity and socioeconomic development. Besides, the agglomeration processes of firms, the increase specialization and use of particular technologies and the generation and diffusion of accumulated knowledge with defined geographical boundaries have been considered as key factors to this study.

Considering these variables, each space must be studied according to their territorial features and competitive advantages generated by major development actors. This is the goal of this thesis, to analyze in what measure the salmon cluster have allowed a socio-economic and institutional development of the region, positively affecting the productive capacity of the region, its ability to generate new knowledge, learn and innovate consistently.

However, although it has given special emphasis on empirical studies to understand the possibility of economic development based on economic performance generated by industrial clusters at regional level, there are only a reduced data about studies analyzing industries that despite they are featured by a reduced capacity to generate and absorb new knowledge, are highly competitive worldwide.

In this sense, it is necessary to use a theoretical framework based on the perspective of RIS in order to study the productive development of the salmon industry in a peripheral region located in a developing country. It is given a special emphasis to the role played by institutions and other regional actors, national and transnational firms, considering their ability to generate networks, organize and coordinate efforts in order to strengthen an economy of innovation. From that perspective, it is interesting to know what are the main factors that prevent or allow the consolidation of a RIS and what could be the main theoretical guidelines, benefits and care that should be considered for the generation of public policies to reduce the gaps and increase the regional innovation capacity.

CHAPTER IV: THE SALMON INDUSTRY IN CHILE

1. Chilean Macro Economical Approach and Salmon Industry

In order to contextualize the development of the salmon industry and its impact at the country level, the following chapter analyzes how the evolution of economic growth and development policies of Chile has enabled the development of the salmon industry. To support this analysis some major economic and population indicators of Chile and the salmon industry are mentioned.

Main Chilean indicators

Table 2

POPULATION (2012)	16.431.929
GINI (2011)	50.3 (high)
HDI (Human development index) (2013)	8,22 (very High)
TOTAL GDP	USD \$ 410.277 billion
GDP (Per capita)	USD \$ 23,165
UNEMPLOYMENT RATE (1985 -2015)	8,2%

Source: Word Bank, 2014

Regarding economic performance of Chile, the country's economic growth over the past two decades has been uneven. For the period 1986-1997 Chile presented a Gross Domestic Product (GDP) average of 7.5%, mainly associated with investments in the

export sector, while in the period 1998 to 2002 it reached only 5.0% as a result of the impact of the Asian crisis recovery in 2004, where GDP reached 6.1%.

Regarding the period 2004-2012, GDP growth remained between 5 and 10% for the most part. However, due to an international crisis, 2009 reached the lowest growth in the last decade, at -1.0 %. Afterwards it recovered, reaching 5.6 % of growth for the year 2012, decreasing for the period 2012-2015 to around 2.5% (World Bank, 2014).

Considering this general framework, since 1980 the salmon production has joined the main Chilean export activities. Indeed, this activity has experienced significant and explosive growth positioning Chile in the last ten years as the second largest exporter of this product of the international market after Norway. Thus, the fishery sub-sector has become a strategic economic niche for the country and the Los Lagos region where this activity is mainly located, turning into the second major Chilean export product after copper, followed by wood and fruit, with returns in 2014 of \$4 billion dollars (www.aqua.cl).

The inclusion of salmon farming in Chile as an exotic species is not recent. However its commercial explosion can be easily linked to the last two decades. This as a result of changes, especially in terms of macroeconomic policies that were implemented in the country during the military regime, whose trademark was based on the exploitation of regional benefits and the development of non-traditional products (Rosales, 1997).

Since some decades, the globalization process of the economy has been initiated based on the neoliberal model. This process has set a new world order, restructured the country's economic policies and forms of production companies, involved widespread consumption patterns, reoriented and relocated in space and boosted labor organizing movements and investments to places where there are comparative and competitive advantages based on the concept of profits (De Mattos, 1989).

Particularly in the case of Latin America and specifically the case of Chile, this process has marked the last three decades by the promotion of an opening export - model based on the primary sector of the economy. Chile has based its economic growth on the exploitation of natural resources by mainly foreign investments. Considering this goal, "Chile has been a pioneer in structural change and adjustment" (Boisier, 1994). These

structural adjustments have been lead in the last four decades in Latin America for the World Bank and the International Monetary Fund, trying to consolidate neoliberal economies to enhance the economic performance of non-developed Latin American (LA) countries. In this context, Chile has positioned itself as a model for the rest of the LA countries that have tried to incorporate these kinds of measures to reduce poverty and reach better social development.

In this context, Chile has defined a development strategy to participate in the international trade based on its comparative advantages. Chile has oriented its economy based on the exportation of low-cost factor production goods (based i.e. on low cost of labor) and natural resources. On the other hand, it has opted to import intensive goods in scarce productive factors. However, over the years, international and national firms in Chile, such as in the case of salmon industry, have had to invest to qualitatively the structure of their exports through inducing factors, such as investment in human capital, science and technology and communications infrastructure, which refers to competitive advantages. Carazo argues in this sense that *“the competitive advantage of nations and regions is in the quality of its human resources and knowledge, able to create and effectively use and apply technology to the needs of production and improvement quality of life, general welfare and regional development. The common element of success of the leading nations are its continued strategy to incorporate new knowledge and technical advances to production, making it more flexible, achieving a greater productivity and growing specialization in high value added and technological content “ (Carazo , 2000).*

In the case of Latin American countries, they have had to adapt their initiatives to the guidelines of the global economy to ensure a social development that ensures the quality of life for its inhabitants. However, this view has forgotten in many cases the impacts that this restructuring has had on various areas of the country, especially on the natural resources.

It is very important to note that many of the efforts that have been made in the economic policy arena have focused and adjusted at all levels to allow the attraction of mainly large companies and foreign international investments. For example, the transport infrastructure has changed considerably to offer to the firms a better flow of capital and

raw materials, improving land, sea and air routes. Territorial planning in this sense is passively adjusted mainly considering the needs of the private sector. The spatial organization is adjusted to maximize efficiency and economic growth.

The lack of influence of public policies to reduce these inequalities, as well as the relevance that has acquired the capital and investment behaviour in different territories have generated the raising of spaces that are absolutely dependent on and vulnerable to private interests and also extremely dependent on public initiatives (public economic resources and investments fostering new private investments). This has been to seen by De Mattos (1989)

“The progression of economic and territorial integration and the formation of large economic conglomerates as central players in the national processes of capital accumulation have encouraged the capitalist penetration throughout the national territory”.

Later, Gatto (1989), added: *“The spread of the new paradigm then means much more than a change in orientation and technical base, modify the social and institutional regulatory framework influences life styles and consumption and defines a type of productive and organizational practice. This best practice technology is based on factors such as greater flexibility, product mix and production volumes, of designs, production routines, capital goods and the labor process, and so on”.* These arguments are particularly relevant because these new structures of production have a defined spatial component and have been the result of the reduction of friction distance and technology development. The process has also allowed for a greater freedom of location by firms, an accentuation of geographical dualism between modern spaces that generate emerging spatial patterns and on the other hand, traditional spaces with inherited spatial patterns that remained less developed.

Theoretically, nowadays the Neo-Fordism process is primarily related to a spatial fragmentation and a flexible production, which has generated, among others, a territorial potential dispersion mainly because the increasing loss of comparative advantages and a new regional division of labor. They are now more likely to locate in any region or in places that were previously impossible, mainly due to the distance to potential markets, management centres, lack of accessibility and communications, etc.

As it was noted above, Chile has maintained strong economic growth for at least three decades and it has been capable of reducing social inequalities and has moved towards a decrease in poverty rates.

However, despite this reduction, the cost associated with economic growth based on the exploitation of natural resources has negatively impacted the environment. According to the Law of the Environment N° 19.300, March of 1994, *“Sustainable Development is a process of sustained improvement and equitable quality of life, based on appropriate measures for conservation and environmental protection, in order to not compromise the expectations of future generations”*.

Consequently, the initial basis for sustainability is to recognize the fundamental interaction of the components and natural processes, their spatial arrangements and how they are transformed into natural resources. On the other hand, the territory also includes the forms of social, economic and cultural organization of space, which is commonly referred to regional development (Romero, M, Rivera, A; Ihl, M, 1996 in Sunkel 1996).

Under this argument, it is valid to ask the following question: How does Chile continue to increase expected growth on the basis that their exportable limited resources in the medium and long term?

As Sunkel argues *“This interaction between the socioeconomic system, which requires environmental goods and services and the ecosystem that provides them, there is a risk that pressure becomes excessive damaging the ecosystem functions failing, damaging socio-economic system itself”* (Sunkel, 1996, 14).

2. Territorial Expression of Exportations

According to Mendez (1997), multinational companies that generate economic activities in a territory (as in the case of salmon) are closely linked to regional and local development in both positive and negative aspects. Positive aspects, are related to: the

sources of capital and direct employment to enhance the development of the territory, the transfer of technology, experience and efficiency in the improvement of the production systems that are installed, modernizing effects, reinforcing the competitive mindset of the business, increase in exports that favour the international integration of regional economies, rising incomes and the level of overall consumption in the region, and so on. Negative aspects are related to the loss of jobs for local business cessation, scarce transfer capital and technology which reduce the development of indigenous firms, imports imposing cultural and consumption patterns deconstructing regional production system, increased dependence on external decisions and regional imbalances, and so on.

“The policy of open economy and export promotion, structurally related to the economic globalization and short-term external debt do not only transform the economies of many Latin American countries, but also its geography” (Daher, 1990).

In this context, the Chilean model has tried to maintain macro-economic policies promoting and protecting the explosive economic growth over the past three decades. Thus, Chile has encouraged a policy of low export and import tariffs, flexible exchange rates, a labor policy that protects a minimum wage and foreign investment policy (Law No. 600 of 1974) promoting external investments of capital in specific industries that indirectly generates spatial effects.

For example, according to Daher, “the exchange rate” differentially affects a sectoral specialization and the geography of exports and imports. An overvalued real exchange rate boosts natural resource areas with comparative advantages and reduces the performance of the import sector, promotes regional development, reduces rural-urban migration, and boosts territorial dispersion and financial concentration especially while lower multiplier affects the export a regional sector has in the region. Conversely, an undervalued exchange favours the import sector and urban areas promoting rural-urban migration (Daher, 1990).

Foreign international investments are undoubtedly an important mechanism for generating macroeconomic contribution of fresh capital, technology, local jobs and a way to promote exports through the opening of foreign markets.

Profits generated by FDI are, however, rarely reinvested in the same regions, reinforcing monopolies of modern technology, which is linked to the characteristics of functional occupation of the space that these investments usually acquire in the regions, reducing sectoral or regional links, defaulting the transfer of technologies, innovations, value chains, etc. and increasing a concentration in certain territories.

FDI generally increases the benefits of large cities, because these places concentrate all of the financial, human resources, commercial, political and information capital. This process reinforces the territorial concentration of economic activities in highly specialized areas that occupy specific spaces in a functional way and are not really integrated to regional market dynamics. On the other hand, the concentration of FDI increases a lack of decentralization in decision-making, political power and especially the dispersion of economic activities (Daher, 1990).

This process establishes the conditions to increase the dependence and relation between undeveloped rural areas with the consolidation of new investments, linking these areas to the world trade system through the coexistence and fusion in the same territory of a modern economic activity and traditional rural economic activities. This generally has meant “the emergence of a modern activity on a traditional society and peripheral insular space, with a diversity of natural environments, many of them sensitive, which has brought important changes” (Arenas, 2001).

3. Salmon Industry

The salmon industry took its first steps at the beginning of the century and established itself in the eighties and nineties. Some authors have used the terminology “Blue Revolution” (Burton, 1997) comparing this process with the “Green Revolution” that occurred in global agriculture. This revolution has been the result of the explosive

production of salmon from the 80' to the present, where productivity has grown steadily and where their exports are growing rapidly year after year.

The significant development of the salmon industry from the beginning was justified by the urgent necessity to reduce pressure on fisheries resources, which were undergoing a major over-exploitation by the increasing demand of human consumption. In addition to this, it was considered as an economic activity capable of reducing migration processes and promoting regional development. Thus, the activity evolved with a relative late boom if it is compared to the most important activities in the Chilean economic activities such as mining, forestry or the fishery sector (in its broadest sense, not including the aquaculture subsector).

The salmon industry, after many failed attempts to find the right place for its production, has been developed in the Los Lagos and Aisén Regions, mainly because of the important natural comparative advantage in these regions compared to the rest of the country.

These advantages are related to ecological and environmental conditions, mainly sea-water conditions and low-cost labor in these regions. An important fishing industry in other regions of the country also provides food for salmon at low cost. Besides this, there is the necessary macro-economic conditions and trade liberalization in the country that facilitate the arrival of foreign direct investment. This is compounded by weak legislation regarding safeguards and inspections that existed and currently exist in care for the environment.

The salmon industry, despite having generated some positive effects on employment in the region (40,000 jobs approximately) and growing national and regional GDP, has initiated and caused other side effects at both the regional and local levels (Foundation Terram, 2001). Among these we can mention the temporary employment, low wages, poor working conditions, rural proletarianization and the loss of a rich cultural tradition of the South-austral regions. It is, then, a socio-economic transformation of local communities through new forms of work associated with competitive economic activities.

Besides this, it is important to note that although this activity was promoted to reduce inter-regional migration, it was an important factor in increasing intra-regional mobility. In the first step, it has turned some places where salmon industry production is located into points of retention and attraction of the regional population. In the second stage, it has transformed these traditional rural areas into points of expulsion areas of people, encouraging rural-urban migrations especially for young people, who favour multiple jobs in order to have access to more sources of income.

The salmon industry has transformed the regional space, considering changes in socio economic patterns, employment structures and organization of regional space, generating spatial imbalances, territorial conflicts and changes in land use and coastal waters, causing further strong impacts on economic sectors such as tourism and fishing, due to the privatization of coastal and marine areas and lakes.

The history of economic public policies in Chile has highly influenced the process and evolution of the main Chilean economic activities such as the salmon industry. Import substitutions from 1960 and more liberal export-oriented policies since 1980 have contributed to the more structural economic scenario affecting industrial behaviour in Chile.

The location of the salmon industry in the south of Chile, mainly in the Los Lagos region, is directly linked to the location and proximity of specific natural conditions to develop some of the salmon industry's productive phases, at least the hatching and fattening phases. Salmon processing phases have been closely linked to low labor costs of the region. On the other hand, commercial phases have been positively affected by the generation of more competitive advantages and national and international conditions developed paralleling the industry evolution. Connectivity and accessibility have been facilitated by geographical proximity and the reduction of transport costs with the increase of technological advances and export facilities developed from the initial market activities.

Figure 1

Los Lagos Region, Chile



Source: Google, 2015

Besides, some positive externalities like the use of knowledge accumulation and institutional development have been the result of the learning process and market evolution of the industry. But, are external economies nowadays a critical decisional factor of firm location? At the very least, there is a general consensus that specialized knowledge has been accumulated by human resources, increasing the attractiveness of the region to new skilled employees, new business opportunities and capital investments. These are indeed some of the aspects that contribute to the current salmon cluster in Chile. But there are other issues to be addressed in order to further comprehend the complexity of the conditions that the sector is facing.

4. Fishery Sector and Salmon Industry in Chile

Chile has acquired a global importance regarding specifically the worldwide production of Atlantic Salmon and Pacific Salmon. According to Chilean Customs Authorities, Chilean exports are divided into 5000 product categories, of which 1000 are foodstuffs exported to 182 countries. Of this total, 10% comes from the salmon industry, which has transformed itself over the last 20 years into a global salmon producer, supplying a third of worldwide production, preceded by Norway, and followed by the United Kingdom and Canada.

Over the last 20 years, the salmon industry, through its dynamism and successful partnerships, has been a consistent driver of national export growth. In 2012 salmon accounted for 3.7% of total Chilean exports after copper, 75% of total exports from the south, and more than 20% of total Chilean food exports (Salmon Chile, 2014). Chilean exports of salmon have increased importantly even though prices show a clear downward trend (-30%). In 1992, Norway almost tripled the tons produced by Chile while today the gap has narrowed greatly. It was expected that Chile would be the largest producer worldwide. However many problems have continually limited this progression.

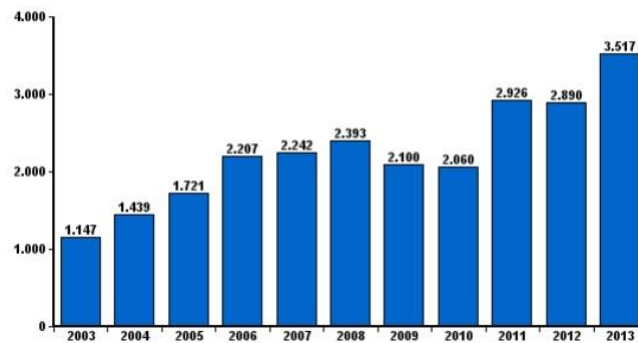
This revolution has been the result of the booming production and export of salmon from the eighties to the present. Growth has been sustained even though the prices show a downward trend in recent years due to global oversupply, which eventually resulted in lower returns for companies.

A clear example that summarizes the current position of Chile in terms of open markets and export policy is the salmon industry. This activity has contributed greatly to raising economic return indexes of the fishing sector.

As was mentioned earlier, the fishery sector has a lot of relevance in the Chilean economy. The Pacific Ocean surrounding the coast of Chile is a source of extreme wealth of marine resources. Over the years, the production of extracted tons has substantially increased. It is important to note that in recent years the rates of production have fluctuated due to closures and restrictions, especially endangered species.

Figure 2

Evolution of Trout and Salmon Chilean Exports (Million Dollars, FOB)



Source: Salmonchile, 2013

This figure clearly shows the quantities produced and dollars generated by the salmon industry and the importance that this economic activity has acquired through the years. In 2003 salmon and trout exportation tripled the returns produced by fishmeal product, a traditional sector of fishery industry, reaching in 2013 US\$ 3,5 billion dollars in exportations.

On the other hand, the percentages of fishmeal product have decreased over time, unlike the salmon and trout products that have steadily increased in percentage. In 1997, a breakdown began in the percentages that historically had placed the product fish meal as the flagship product of the sector. In this way, it has produced a significant change in terms of revenue for the fisheries sector between these two products that today is led by the salmon industry.

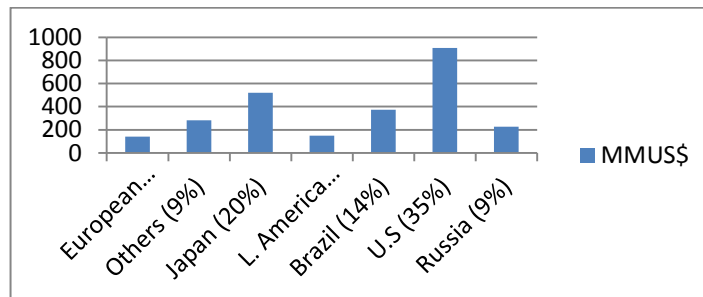
The decline in exports of fishmeal is explained by the reduction in catch of some species (Spanish sardine, anchovy, etc.) and other economic reasons (closure of species, climate phenomena such as El Niño current, etc.). The recovery of fishmeal exportation from 2001 to 2014 may coincide with increased worldwide demand for the salmon industry is because their diet is based on this specific product.

Regarding the main export markets of the salmon industry in 2013, USA and Japan make up around 55% of the total market, followed by Brazil and other countries. All of those exportations have been supported by different benefits signed in Free Trade

Agreements with specific regional blocs such as MERCOSUR, NAFTA, and European Union, however, this argument does not in any way seek to be exhaustive but rather illustrative.

Figure 3

Destination markets for Chilean exports of Salmon and Trout (Million Dollars, FOB)



Source: Salmonchile, 2015

As it is shown in Figure 8, today the main destination of salmon and trout exports is U.S and Japan, making up around de 55% of the exportations. Before 2001, the leading destination was Japan, initiating in this year a significant change of the country and continent destination of export salmon, modifying the geography of salmon exports for this period. Moreover, it is quite logical that the export destinations to the European Union reduced because these markets are primarily covered by countries that belong to that economic and political union (Norway, UK, Ireland, Finland, etc.).

These figures, on the one hand, may shed lights about the important concentration of Chilean market salmon exportations to specific destinations increasing the vulnerability of the business if some country reduces the demand of the salmon products.

Table 3

Growth in Production by Species (2005-2013)

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Salar	385.779	376.476	331.042	388.847	203.067	122.744	264.354	398.316	490.300
Coho salmon	102.494	118.221	105.477	92.317	133.308	114.338	159.585	159.745	148.100
Rainbow trout	122.962	150.608	162.406	149.411	149.741	215.367	224.569	262.674	153.800
King salmon	2.904	1.958	1.910	72	596				
Total (TONS)	614.139	647.263	600.835	630.647	486.712	452.449	648.508	820.735	792.200

Source: Sernapesca.

Source: Sernapesca, 2015

According to table 13, during the period between 2005 and 2013, the total tons of salmon produced in Chile grew steadily, especially the Salar or Atlantic salmon.

Considering the history of salmon farming production and exportation, Chile began a century ago with the introduction of trout for sport activities. Initially, farming was developed by the cultivation of Coho Salmon (silver) and freshwater and sea trout. However, the need to ensure harvest and a consistent production of farming every year (which does not happen with the Coho variety because it is harvested only in summer months) prompted the specialization of the Atlantic salmon (red orange) since the early 1980`s.

The following events can be understood as the major milestones of salmon industry activity in Chile:

YEAR	SALMON INDUSTRY MAIN EVENTS
1902	First initiatives to introduce farming of exotic species such as trout. The rivers of central Chile are seen as the best possibility.
1906	First salmon hatcheries born in Chile (Rio Blanco, V Region). The eggs came from Europe (Spain and Germany). Later, all were killed by turbidity of the rivers.
1907	First State law of fisheries in Chile (Frederick Elbert). This opens the possibility for the state to lease sea spaces with a maximum of 4 hectares for fish farming. From this law further attempts were made to improve this economic activity.
1907 - 1912	Continued efforts in different geographical areas, mainly in river water in southern Chile, as rivers Calle-Calle, Rio Bueno, Cautín, etc.
1927	Attempts to extend salmon farming to Magallanes River, Chile.
1927- 1952	Very important period in terms of scientific research. Start initiatives trying to export

	Chilean eggs to Peru, Argentina and Ecuador. All these attempts were unsuccessful. In addition to this, 50,000 eggs were distributed in northern Chile.
1964	The IFOP (Fisheries Development Institute) is created which is responsible for studying technical and environmental conditions in different leaders countries of this activity (Norway, Scotland, USA Japan, etc.).
1969	A cooperation agreement between Chilean and Japanese salmon producers was developed in order to propagate the species. This is perhaps the most important milestone in the history of Chilean salmon industry. The first effort was made to take advantage of the experience of countries where this activity was already developed. This allowed for Chile to have expert Japanese technical assistance and was an opportunity to prepare Chilean professionals in different culture techniques, diseases and salmon feed, which helped for the development of the Chilean salmon industry.
1970	First craft cages are installed on Lake Llanquihue for scientific and economic proposes. In this new scenario, during the 1970's research activities were increased and private firms began to practice with salmon farming for the first time. Some locations chosen for salmon farming were Pullinque and Panguipulli lakes, Pescado River, and Chiquihue and Huito locations, all located in the Los Lagos region.
1975	First National industrial company in Lake Llanquihue began exporting farmed salmon in Chile (Lago Llanquihue Company).
1978	International cooperation. Creation of Fundación Chiquihue as the result of cooperative program between Chile and Japan.
1983	<p>After some attempts to produce salmon using open circuit or sea ranching, producers choose the enclosed or confined farmed. The "sea ranching" method was a technique where producers leave the salmon in the rivers and catch them later when they are at an appropriate weight to be captured. With the "confined" technique the first Chilean salmon exports were generated, which meant that from the 1980's' on, farmed salmon multiplied rapidly.</p> <p>Since then, it is difficult to follow a historical linearity in relation to companies which have existed, primarily because of the continued sale and joint production companies to large conglomerates and because of the business strategy, that continuously change the name of the firms to avoid legal responsibility mainly related to employment areas (Terram Foundation, 2001).</p>
1986	Creation of Salmonchile, a gremial institution that grouped the main national and international salmon firms
1990	Creation of Salmoncorp, an associative private organization formed by 13 domestic firms (30% of total production) with the aim to support export activities, find new market opportunities and marketing activities.
1991	General Law of Fisheries and Aquaculture. It encompasses hydro biological regulations, aquaculture concessions and authorizations, operation of aquaculture concessions and ocean ranching regulations. This general law reduced financial speculations based on concessions that were easily provided from 1980 considering investment funds. This law generated an important delay in the license application until 1997 because other public organizations became part of this application procedure, hampering the development of the salmon industry (Bjørndal and Aarland,1999).
1993	Creation of INTESAL (Instituto Tecnológico del Salmon) by the Association of Salmon and Trout Producers in Chile
1997	Incorporation of the "environmental impact study" for aquiculture license applications under the revision of CONAMA. According to Bjørndal and Aarland (1999) this procedure added new barriers in terms of cost and time to the emergence of more small firms.
1997	U.S makes an accusation of dumping against the Chilean salmon industry
1998	The Asiatic crisis affected demand and salmon prices. Period characterized by overproduction.
2001	The Ministry of Economics created environmental and sanitation regulations for aquaculture (RAMA and RESA). The "Ley General de Pesca y Acuicultura" stresses the

	prohibition to generate anaerobic seafloors in lakes and sea where phases of the productive process are developed.
2002	Sub Secretary of Fisheries created the National Commission for Aquaculture and Fisheries.
2003	First code of “Good Practices of the Industry” developed between the salmon industry and Chilean government. The main goal of the “Acuerdo de Produccion Limpia” (APL) was to incorporate around 40 environmental measures.
2004	Sub Secretary of Fishery generated a new National Aquaculture Policy in order to regulate the development of the aquiculture sector.
2008	First apparition of Isa Virus in Salmon farming that produce high levels of mortality directly impacting the industry development
2009 -2015	Due to the important impact produced by the ISA VIRUS it was necessary to introduce a new production model to the sector, based on specific measures to extinguish the virus such as maximum of salmon densities in wave-cages, a redesign of the public concessions given to salmon farmings, mechanisms for an early detection of salmon diseases, and new health conditions that group medication, vaccination and other restrictions. This new production model was based on a coordinated private and public program that was agreed on by regional and national actors in order to re –impulse and recover high levels of competitiveness of the industry. Many of those aquiculture regulations were incorporated in the revision of the “Ley General de Pesca y Acuicultura” in 2013.

5. Comparative Advantages of Salmon Production in Chile

Some basic essential conditions explain the great growth that this activity had in Chile. Amongst them we can mention: natural geographical characteristics present in the south-austral regions of Chile, the cheap labor and an important fishing industry that provides food (fishmeal) to salmon at very low costs. Another very different but driving factor is the great facilities that the Chilean state gives for the insertion and development of foreign capital linked with salmon industry in the country and the reduced control regarding labor and environmental impacts of the activity reducing the cost of production of salmon compared with other countries.

a. Macro-economic advantages

The increased growth and development of salmon farming is closely based and related to macro-economic conditions designed to insert the country into a process of economic opening since the 1970`s. These include policies regarding foreign investment, exchange rate policy and labor flexibility policies allowing the existence of temporary employment. But still, legislation regarding safeguards and inspections that are in care of the environment are missing.

b. Regulations

The development of salmon farming in Chile has been subject to different legal regulations that have been changed and modified in function of the increment of salmon production and the impact of this activity on various areas (social, ecological, economic, etc.). However, until a few years ago, there were no specific rules ensuring the performances of this production sector in a more rigorous and committed way in order to reach sustainable development of the country. The first regulatory framework to be submitted to the salmon industry was the basis of the Environment Act of 1994, only effective with the creation of the Aquaculture Regulation of Concessions in 1997. Before this Aquaculture Regulation only a few companies voluntarily elaborated an Environmental Impact Statement.

With the Aquaculture Regulation of Concession a legal criterion for the location of salmon farms was provided. From 1997, it was mandatory to salmon producers, before starting any new salmon farm production, to submit the project to the System of Environmental Impact Assessment (SEIA). After the SEIA was approved, the Undersecretary of Fisheries and the Ministry of Defence approve an Aquaculture Grant, administrative act empowering a legal or natural person to carry out aquaculture activities in seas and rivers indefinitely. Eventually, the National Marine Fisheries Service deliver the aquaculture concession (annually have to be paid 2 UTM (75 US dollars approx. Dollar, 2/01/ 2012, 519 Chilean pesos = 1 dollar) per 50 hectares and 4UTM per additional hectare) (SERNAPESCA, 2005). Currently, the law that regulates this activity is the General Law on Fisheries and Aquaculture, established in October 2002 and reviewed in 2013, incorporating important regulations aimed to preserve the sustainability of the industry and reduce the possibilities of a new ISA virus crisis.

Just for balance, until 2005 and under the current Fisheries Law, 11.534 applications for concessions were requested by 3.446 people. Of these, 74% were individual persons, 19% legal persons and 7% “traditional local fisherman associations. In 2004, 50% of aquaculture concession applications were given for salmon farming, 43% for shellfish and 7% for algae cultivation (SERNAPESCA, 2005).

Regarding aquaculture concessions already granted, authorities identified a speculative informal market where concessions granted by the State were traded. For this reason and others, the executive power decided to modify the Fisheries and Aquaculture Law.

It should be mentioned that although there have been important improvements in the regulatory frameworks of salmon industry, now many companies that should submit their economic activities, only elaborate an Environmental Impact Statement, which is less demanding in terms of the adoption and development of management plans to ensure environmental sustainability.

c. Allegations of dumping

An important accusation of dumping was initiated by Scotland, Ireland and the US in 1995. The aim of this allegation was to demonstrate that Chile was producing fresh and frozen salmon below the cost of a normal production. But soon, in 2002, these allegations were ended and it was declared that Chile had respected the Anti-Dumping Agreement of the WTO. The labor dumping is a disadvantage for producers in other countries that pay a higher value on their workers compensation, contrary to what happens in Chile where compensations are extremely low.

On the other hand, the accusation of environmental dumping in the Chilean case was established, among other reasons, because the lack of internalization of negative external economies, the lack of payment to environmental cares and the use of chemicals in the productive process not accepted worldwide (Malachite green). Those factors reduce production costs and affect the competitiveness of the salmon market. After several investigations these charges were not proven, however, they still damaged the image of Chilean production.

Some of these accusations came from countries like the U.S, Ireland and the United Kingdom. The last two countries have proposed the application of a restriction (overcharge tariffs) on the Atlantic salmon imports from countries outside of the European Union. The strong defence initiated by the Chilean government to stop

allegations shows the great importance that is attributed to this activity and expectations for its future expansion.

After these allegations, companies have had to initiate an aggressive diffusion to be able to clean the image of Chilean products, and have also had to recognize the importance of healthier products for the environment and the population. Such progress is very important, especially now in the context of the economic openness and Chilean free trade agreements where international regulations such as ISO laws must be respected.

According to Schaper (2003), the increasing specialization of resource-intensive industries and the relative loss of technological knowledge-intensive industries, places the region in a vulnerable position in terms of environmental requirements to participate in the markets of developed countries.

This calls for an urgent restructuring of market strategies, considering that the world market is increasingly demanding “safe and clean” products in terms of local environmental conditions. Today, this condition is seen as a marketing strategy for all companies in the world in order to increase customers and profits.

In Chile, the NGO Fundación Terram (2000) believes that salmon farming is unsustainable and is not currently fully internalizing environmental costs, where 25% of the profits obtained correspond to the non-payment of environmental compensations.

The environmental claims are mainly related to the negative impact that the salmon industry generates on the waters, causing a “eutrophication” process. The seabed under the farms is covered by food not eaten by fish and also by the waste that is generated by salmon that goes directly to the sea bottom, killing natural vegetation and local fauna. Traditional studies have concluded that the environmental impacts of the salmon industry are linked also to the sedimentation process from leftovers as a result of inappropriate feed management and salmon bio-deposition killing flora and fauna on the seafloor, the apparition of algae, phytoplankton blooms and finally the release of waste and waters with high nitrate levels to the ecosystem.

The introduction of exotic and carnivorous species such as salmon and trout brought new pathogens to the ecosystems affecting the local food chains. However, Buschmann, et al, (1995) argues that methodological studies have not been carried out rigorously and it is necessary to take into account specific conditions of bays and fiords. Soto and Norambuena (2004), in the same context, stress the lack of consensus about the magnitude and environmental effects of the salmon industry. However, studying 43 specific salmon farming areas they found significant concentrations of nitrogen, phosphorous and organic carbon in sediments.

The salmon industry is aware of its environmental impacts. In this context some initiatives have tried to mitigate these effects by increasing technology investments. For example, a specific machine was designed to give a precise amount of food to salmon and thus prevent that surplus fail to the seabed. That issue is really important because the salmon food makes up 50% of the total production costs of the activity.

Regarding the problem of bio-deposition, as a solution to increment the control over water concessions, incrementing the continuing re-localization of farms allowing the normal cycle of water and the pause of other production sites has been proposed. Moreover, in order to minimize the impacts of water eutrophication “collectors of mortality” have been used in cages, preventing dead fish from going to the seabed.

The industry has been highly committed to improving the environmental standards of overall activity. In December of 2002 the Clean Production Agreement was signed by the public and private sectors of the Los Lagos region (centre of the Salmon) and the National Marine Fisheries Service (SERNAPESCA), the National Environment Commission (CONAMA), the salmon industry Association (Salmonchile) and Intesal, specifying 40 concrete actions to improve in this area. On the other hand the Integrated Management System of Salmon (SIGES) was elaborated seeking to establish a collective behaviour in the sector and satisfy global consumers through higher quality standards.

d. Natural Resource Advantages

Important Chilean comparative advantages have allowed the concentration of this activity in the southern regions of Chile, mainly in the X region, which currently accounts for 90% of the farms at the regional level.

The natural conditions, climatology, temperature of sea water, geomorphology, etc. that are present in this region are the most favourable to the development of the salmon industry. According to experts, the best location on a global scale would be given in a strip that extends between 40° and 60° latitude North and South (Rosales, 1997). In the case of Chile, specifically, this location extends from the La Araucanía region to the Aysén region (Latitude 40° South to latitude 50° S). Those physical potentialities that make up the Chilean territory are a critical comparative advantage for the activity. Marine geomorphology characterized by the existence of lakes, inlets, bays, fjords and sea channels makes possible the existence of marine locations protected from the wind and local ocean currents that renew the water continuously. Moreover, due to the geomorphology of the fjords the installation of cages farms over a hundred feet of depth at small distances from the coast is possible, allowing for better accessibility, especially for staff working in the floating cages.

We must add to these advantages the positive characteristics of water bodies, both lakes and marine, because present temperatures, salinity levels, pH, oxygen, no pollution, etc. are appropriated to growth and development of the salmon. It is possible to add the small distance and accessibility between water bodies (lake and sea) that are part of the chain of production process, which facilitates the transport and management of fish from one place to another and finally geographical distance to high urban cities.

Technically, experts say that there are only a few regions of the world with those natural comparative advantages for the cultivation of salmon as favourable as those in the southern regions of Chile, regarding excellent quality of water, with ideal temperatures ideal ranging between 7° and 16°C in winter and summer months respectively, which are also added to the excellent luminosity and purity of the water.

Other than the purity of sea and lake water, it is important to note that the amount of oxygen dissolved in water (7 to 10 mg / l) and the salinity are consistent with the respiratory needs of the fish in captivity. In addition, water movement and the depth of the sea allow for farming salmon properly, and it is possible to work without major problems, considering the geographical patterns and topography of the sea bed (El Mercurio, 28/02/2003).

It is for these important geographical features that the salmon industry has had the conditions to grow so rapidly in the sea and lakes of Los Lagos region, especially in the island of Chiloé, a central eastern archipelago of the region, where a high percentage of salmon farming is located, setting a concentrated pattern of location of these activities in that area.

e. The low cost of alimentation for Salmon

Another comparative advantage that salmon industry activity has in Chile is the low price of feed used in the productive process of fattening of the salmon in farming.

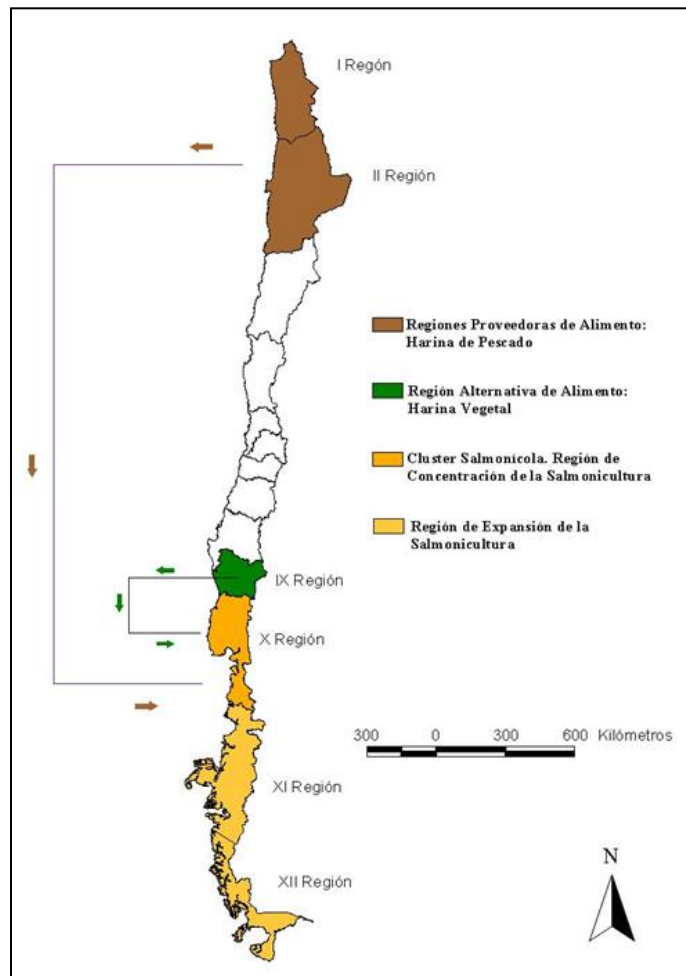
Fish meal is the base of salmon food and comes from the north of the country (“Tarapacá” and “Antofagasta” regions) and also the south “Bio Bio” region.

It presents lower prices when compared to food costs in other countries. However, there is a fundamental contradiction in this process. It is argued that the benefits of salmon production as a source of food for society and as an activity are able to reduce the pressure on fishery resources. However, this approach is relative since traditionally the base of salmon food has been based on fisheries stocks that have significantly declined recently, precisely because of the over exploitation of this resource.

A study by Naylor (2000) notes that 2 to 5 kilos of fish meal are needed to fatten a salmon by 1 kilo in captivity. In 1994, 15% of fishmeal was used in aquatic cultivation, of which 27% corresponded to salmon farming (Fundación Terram, 2001).

Figure 4

Chilean Regions participating in the Salmon Industry productive process



Source: Own Elaboration, 2005

Regarding this problem, in recent years academic and salmon firm research have opened up other possibilities for food. This new food would be elaborated mainly using organic materials from agricultural origin such as Raps and Lupino. In this context, this new possibility would involve especially? other agricultural Chilean regions such as “Libertador General Bernardo O’Higgins”, “Maule”, “Bio Bio” and “La Araucanía” region. At the moment, the fishing pressure continues to carry out this food process of the salmon, involving mainly regions dedicated to the fishing industry, such as “Tarapacá” and “Antofagasta” regions.

f. Low cost of Labor-force

There is in the region an important platform of low-skilled employees with previous experience in the fishery sector that receives low salaries compared to European countries. However, there are also a significant number of professional and specialized human resources in the salmon industry. These employees have migrated to the region from other national regions or have been educated and trained in the region by institutions and universities.

CHAPTER V: GEOGRAPHY AND INNOVATION OF THE SALMON CLUSTER

1. The emergence of the Chilean Salmon Cluster

The explosive growth of the Chilean salmon industry has turned Chile into the second largest salmon producer around the world. This goal has been linked to the capacity to generate scale economies in salmon and feed production, as well as the processing and distribution phases saving costs with the progressive incorporation of new technologies (Asche, 1997 in Olson and Criddle, 2008, SERNAPESCA, 2014).

The salmon industry is positioned as an export-oriented industry. However, the extreme dependency of the salmon industry on external countries and especially the US and Japan increases the vulnerability of the salmon cluster to international economic trends (Bjørndal and Aarland, 1999).

Studying the salmon industry in Chile, Lisuka (2006) stresses the importance of low-tech industries as a new path for regional development. The salmon industry has been featured by important catching-up efforts to reach global high standards. In this context, the industry requires regional actors to improve institutional arrangements, the learning process to increase levels of value creation and knowledge management such as organizational capabilities in order to become a more competitive economic activity capable of supporting sustainable regional development. The author also stresses the possibility of matching high-tech industries' behavior by introducing some structural changes in the salmon industry in Chile: 1) increasing industry firm concentration by mean of merger/acquisition processes, promoting innovations, 2) increasing value-added to products, 3) externalizing processes by new specialized suppliers, promoting forward linkages, 4) pulling technical progress in new products and 5) enhancing the collective capabilities of the industry.

Montero (2004) has linked the explosive growth of the salmon cluster with competitive advantages of the region, such as public support and regulations, entrepreneurial capacity to develop market opportunities, associability (i.e., public and private cooperation to advance in industry regulations), local technological learning covering all phases of the productive process in the region, high competitive local suppliers of product and services and a specialized regional human capital supported by research institutions and regional universities. However, the systematic incorporation of new technologies in the future will also be necessary, especially in order to increase the productivity of salmon workers.

According to Salmonchile (Trade Association of Salmon Producers in Chile), Norway, in 2002, presented triple productivity compared to Chilean workers occupying 16,500 workers versus around 35,000 workers in Chile. However, this important difference in productivity continues today. In fact, Salmonchile estimates that in 2014 there were around 60,000 workers linked indirectly and directly to the salmon industry, one-third of which were in Norway and produced around double the amount of tons of salmon than workers in Chile (Salmonchile, 2014).

On the other hand, the increasing concentration of Chilean and international salmon firm producers by merger/acquisition processes has reconfigured the map of regional

and global actors that participate in the salmon cluster, regional linkages and the salmon value chain. In 1992 there were 63 salmon firm producers that were reduced to 40 in 1999 (Lisuka, 2006). In the same context, based on IFOP (Instituto de Fomento Pesquero) information, Bjørndal and Aarland (1999) have also noted that the evolution of the Chilean salmon industry will continue towards a significant industry concentration of large companies. In fact, according to other results from Vera (2009), the concentration of salmon processing companies decreased in the period 1994-2008, from 100 to 49 firms. According to SOFOFA, Sociedad de Fomento Fabril de Chile (2010), only eleven large firms in 2010 made up 60% of the total salmon exportations. According to SERNAPESCA (2014), only four firms: Marine Harvest, AquaChile, Mitsubishi, Los Fiordos and Multiexport Foods made up around 50% of the total market in 2014.

The significant concentration of large firms is highly related to the increasing trend of international firms to vertical integration of all the phases of the salmon productive process. For instance, according to Vera (2009), Multinational Nutreco Company bought Biomaster, Marine Harvest and Pesquera Mares Australes Company. In 2005, Marine Harvest acquired Pan Fish and Fjord Seafood reaching a total production of 420,000 tons, or 25% of total world production. AquaChile acquired domestic firms Aguas Claras and Salmones Chiloé and also the European firm Robinson Crusoe. Regarding food supply firms, there are 5 firms that make up 100% of the total market: four are international firms, Nutreco, Ewos, Biomar, Alitec and only one is a national firm, Salmonfood. However, despite the high concentration and reduction by firm acquisitions of large and more consolidate salmon producer companies, there are some economic activities that are performed by around 500 micro, small and medium supply firms participating in the salmon cluster. Of them, 400 are linked to service firms and 100 firms provide diverse specific inputs.

In this context, despite the important trend of concentration and the vertical integration of Salmon TNCs producers, the salmon cluster is still featured by the intense utilization of forward or backward linkages. According to Olson and Criddle (2008) over half of all firms of the salmon cluster have market interactions toward market or supply direction in all phases of the productive process. Perez-Aleman (2005), stresses the important interdependence and interaction of TNCs with domestic local firms in the

salmon cluster in transferring ideas, capital and organizational know-how. In 2002, there were approximately 90 Chilean SMEs providing different products and services such as feed, equipment for the hatching and processing phases, pharmaceutical inputs, logistics and transport, and packaging, etc. (Maggi, 2002). These firms have progressively been able to generate technological inputs that were imported before mainly from European countries. This is a very important outcome for proposals of regional analysis that we will pursue further.

According to Lisuka, 2006, the increasing competitiveness of the salmon industry in the last two decades has encouraged the generation of new value added products, at the same time impacting the necessity to invest and improve productive capacity, incorporating new machinery, technological processes, transport solutions and therefore new skilled workers. At the same time the generation of new products meant the emergence of new supplier firms in the regional setting promoting forward linkages.

Currently, different economic activities have grown providing inputs to the productive process of salmon industry. The capacity to generate more value-added and productivity has been closely linked to the support of regional organizations and institutions increasing organizational and technological capabilities. It is important to stress that salmon cluster conformation currently featured by vertically and horizontally integrated TNCs has been an evolved process that was initially featured by the apparition of isolated and independent firms in all phases of the salmon productive process (Olson and Criddle, 2008). In this context, the salmon cluster has been conformed following a bottom-up evolution lead by regional firms (Felzensztein, et al 2010). It is also recognized that public and private efforts and coordination initiatives have allowed the generation of a well know Chilean brand in international markets of salmon production (Perez-Aleman, 2005).

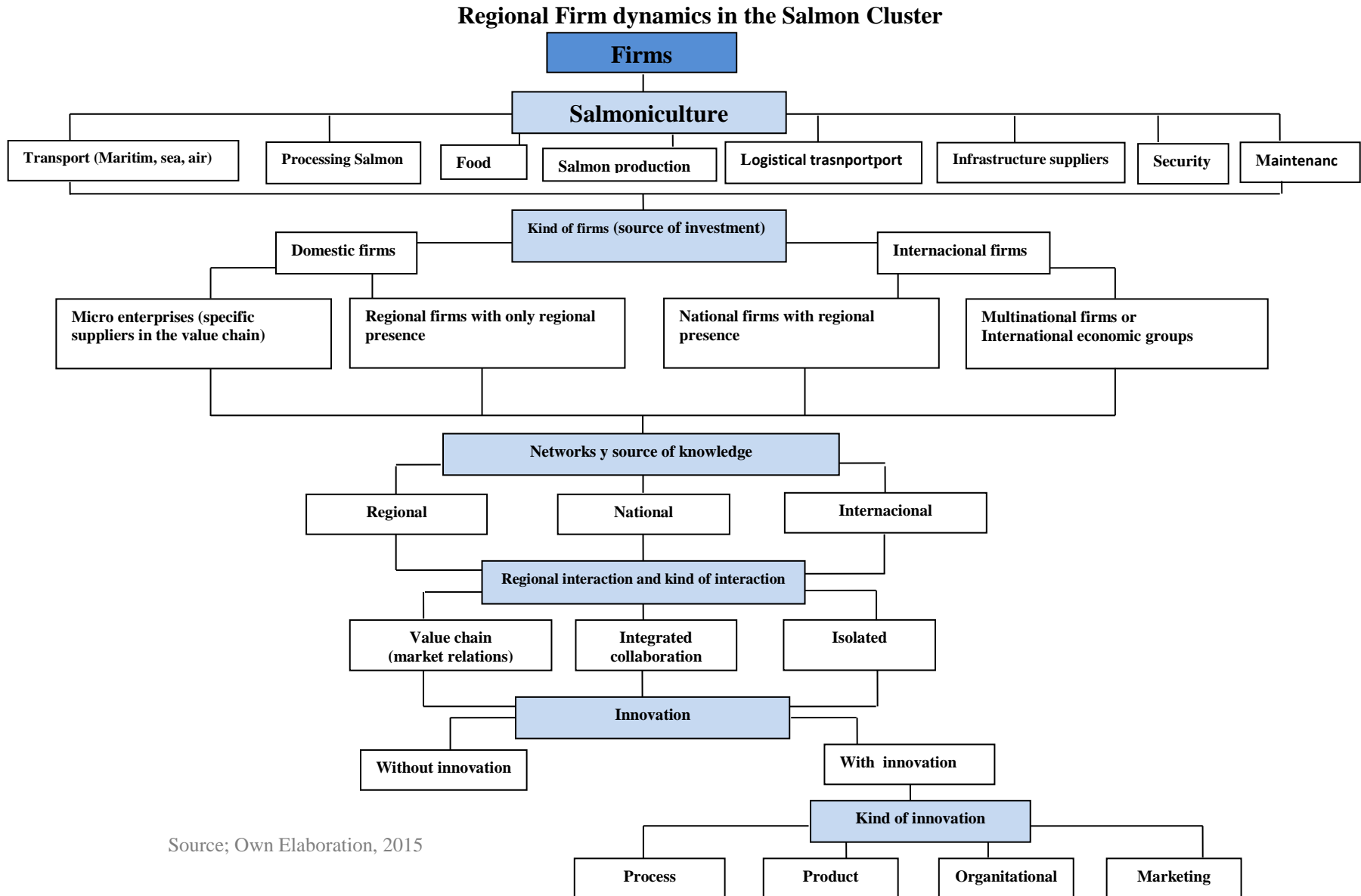
The Chilean salmon industry has developed and evolved regarding factors such as price, new global producers, demand markets, access to specific inputs, new technologies and so on. However, the main competitive advantage today is linked to the capacity to include traceability and assurance of food-safety of salmon products, considering high standards of employability and reduced environmental outputs but maintaining low-costs and scale economies. In this context traceability will depend on firm productive

structures (firms with stable horizontal supply integration and vertical market integration reduce cost transactions of information), coordinated public policies and industry efforts to transfer good information through the value chain (Olson and Criddle, 2008).

The trend of the Chilean salmon industry is marked by a neoliberal process of ultra-concentration of large firms. The future scenario will likely be featured by a more reduced number of high-size international companies vertically and horizontally integrated encompassing all of the phases of salmon production augmenting the capacity to generate scale economies. Current fragmented companies tend to cooperate and share information; however, most likely these more SME firms will be acquired by TNCs increasing the firm concentration and reducing cluster characteristics (Olson and Criddle, 2008).

The main regional dynamics that conform the salmon cluster can be visualized in the following figure, where some specific features of the firms are identified, such as if they are part of a company group or not, the origin of investments, specific economic activity in the salmon industry productive process, and level of interaction.

Figure 5



Source; Own Elaboration, 2015

2. Characterization of Salmon Firms in Chile

As stated before, the salmon cluster is mainly conformed by different kinds of private companies that may be categorized by transnational companies, medium national or international firms and national micro and small firms.

Table 4

Main Firms of the Chilean Salmon Cluster

NAME FIRM	PRODUCTION AND LOCALIZATION	EXPORT. 2001 (US\$ MILL)	ORIGIN CAPITALES
Trout-Chile group Nutreco	Alimentos (Osorno). Piscic., cultivo, Proces., Comerc. (Lgo.Llanquihue, Pto.Montt, Chiloé)	240,0	TNC, Holland capitals
Ewos-Chile	Alimentos (Chiloé y Coronel,VIII Región).	115,0	TNC, Norway capitals noruegos.
Grupo Aqua Chile	Piscic., cultivo y Proces. Comerc. (Gala, Pto. Cisnes, Chiloé, Pto. Montt)	100,0	Northamerican and Chilean Holding
Camanchaca S.A.	Piscic.,cultivo, Proces. (Pto.Montt, Chiloé)	75,0	Chilean group
Multiexport S.A.	Piscic., cultivo, Proces. Comerc. (Pto.Montt, Chiloé)	60,0	Chilean and Japanese capitals
Salmofood S.A.	Alimentos (Chiloé)	60,0	Chilean
Mainstream S.A.	Piscicultura, cultivo y Proces. (Chiloé)	56,3	Chilean
Fjord Seafood Chile (Nor-Chl)	Piscic., cultivo, Proces. Comerc. (Aysén, Chiloé, Pto.Montt)	53,6	Norway
Alitec (Hol)	Alimentos (Pargua, Chiloé)	50,0	Holland
Salmones Antártica (Jap)	Cultivo, Proces. (Aysén y Chiloé)	45,0	Japanese
Biomar S.A.(Chl-Nor)	Alimentos (Pto.Montt)	42,0	Norgway
Cultivos Marinos Chiloé	Cultivo, proces. (Chiloé, Aysén)	40,0	Chilean
Aguas Claras S.A.	Piscicultura, cultivo, proces. (ahumado).	37,0	Chilean holding
Invertec-Mar de Chiloé	Piscicultura, cultivo, Proces. (Chiloé)	35,0	Chilean Holding
Los Fiordos Ltda.	Piscic., cultivo, Proces., Comerc. (Chiloé, Aysén)	35,0	Chilean Holding
Ventisqueros	Piscic., cultivo, Proces. (Pto.Montt)	25,0	Chilean
Trading Unimarc	Cultivo, Proces., Comerc. (Chiloé)	25,0	Chilean

Source: Maggi, 2002, from Aquanoticias a partir de información de SalmónChile.

2.1. Trans National Companies (TNCs)

There are some firms that have advanced in vertical integration incorporating all stages of the productive process, from egg generation to commercialization/exportation. They present a frequent acquisition of domestic firms and have a reduced horizontal integration generating reduced territorial interaction. However, other firms have externalized specific tasks and stages of the productive process incorporating in the value chain other regional domestic firms. They have very low skilled employees in the productive process, however present high skilled employees to support logistics, commercialization and the management process. Because they are international firms they have access to finance annual production based on their own annual cash flows and finance institutions that commonly give credit at lower interest rates than financial institutions in Chile (Fernández and Briones, 2005). TNCs have developed important channels of distribution subsidiaries in final markets.

2.2. Medium national or international firms

They generate an important regional integration, are generally supply firms and less innovative firms, however, they reach international standards. They are commonly part of national capitals. They have financial access to cover potential investment, technological acquisition and working capital (Montero, 2004). They generally imitate or adapt new technologies generated in other more innovative firms to support multinational enterprises in the region. Fattening and security firms present high levels of associability (Innovative adopters).

2.3. Micro and Small firms

They are currently suppliers of medium firms, and they rarely have direct market relationships with multinational firms. Most of them are currently linked with more basic suppliers such as net cleaning, cage manufacturing, and antifouling paintings. They are commonly the result of regional capitals.

Table 5

Supplies Firms of Salmon Farming Industry

	Fresh water phase		Cultivation Phase		Processing phase	
	Goods	Services	Good	Services	Good	Services
Domestic	Fish feed tanks, nets, buoy, cage, egg, iodine, some simple machineries	Maritime and land transports (trucks, tractors and ships) maintenance of cages and nets (antifouling painting), veterinary services	Fish feed, cage and buoy, nets, medicines (vaccine, antibiotics, immune depressors) pigments, smolts, ultrasonic, iodine	Maritime transports (trucks, tractors, ship and well boat) maintenance of cage, nets, harvesting services, veterinary services (vaccine)	Salmon and trout, packaging, material (plastic bags, aluminium, coated trays, polyethylene trays etc) salt, sugar, detergents, iodized soaps, charcoal	Transports (trucks, ship, air) traders, services, waste cleaning
Imported	Automatic feeders, computers, oxygen systems, machine to count the eggs and alevines	Genetic services	Automatic feeders, computers, sensors, underwater cameras, nets, pigments and medicine (vaccine)	Laboratory services	Cutting machineries, skinning machines, smoking machine, replacement knives, parts, detergents, injectors	Transports, trading, marketing, retailing

Source; Lisuka (2006) based on Montero (2004)

All of these productive stages that involve alevin, smoltification, fattening and processing in the salmon productive process, have opened new entrepreneur opportunities for micro and small firms. They have changed urban and rural dynamics, the structure and composition of the market employment and the active economic population. They have also directly impacted other economic sectors such as construction, transport, etc. According to UN (2006) around 53% of the industry expenditures are used to buy specific goods and 47% are expenditures of services that are provided by a well-developed net of specialized firms in areas such as eggs, feed increasing opportunities to entrepreneur initiatives and more skilled jobs opportunities in the region attracting and accumulating new knowledge at regional level.

Torres and de la Fuente (2009) have empirically concluded that the main factor that determine the positive share market participation of manufacturer supply firms in the salmon industry (covering around 50% of the industry demand) are sectoral specialization,

product and process innovation dynamics to solve continued specialized industry requirements, and horizontal cooperation through joint ventures. Other internal factors are related to manager capabilities and skills of employees, the capacity to extend credit to customers, marketing activities, the age of the firm, internal innovative and financial capacity and the level of specific product specialization. The study also shows that supply firms have become an important promoter of the technological evolution of the cluster, a source of employability and a factor of generation and transference of tacit knowledge in the region.

3. Spatial Organization of the Salmon Cluster

In order to shed light about the development of the salmon industry in Chile, the productive process and functional and spatial organization of the salmon industry it is analysed using secondary information and primary information from interviews of regional actors, especially those linked to salmon firms and salmon industrial associations.

Firstly, it is important to underpin that the concept of spatial organization refers to the distribution of all human activities in a geographical space, with the implicit recognition that there is some order in this distribution generated by the interaction of systematic factors that govern the location relationships between activities (Hermansen, 1977).

Understanding that the salmon industry has a defined spatial expression, functional analysis and territorial implications will be discussed considering two basic dimensions:

- ❖ The identification of the different stages or phases of the salmon industry production process in the study area and the location of these activities on marine and terrestrial spaces.
- ❖ The processes of sea, land and air transport involved in the development of this activity.

Since only some activities of the productive process are developed in the “Los Lagos” region, the space organization involved in the salmon industry should be analysed at different scales of analysis.

Table 6

Spatial Organization of Productive Process of Salmon Industry in Los Lagos Region

SCALE	Regional MESOSCALE	MACROSCALE
Localisation	IX Región X Región (Chiloé)	Chile: Atacama, Antofagasta and Tarapacá región World: Europe, U.S, Japan, etc.
Stages of productive process	<ul style="list-style-type: none"> • Incubation • Alevin stage • Smoltification • Harvesting • Processing • Salmon Fattening process 	<ul style="list-style-type: none"> • Origin of food • Commercialization

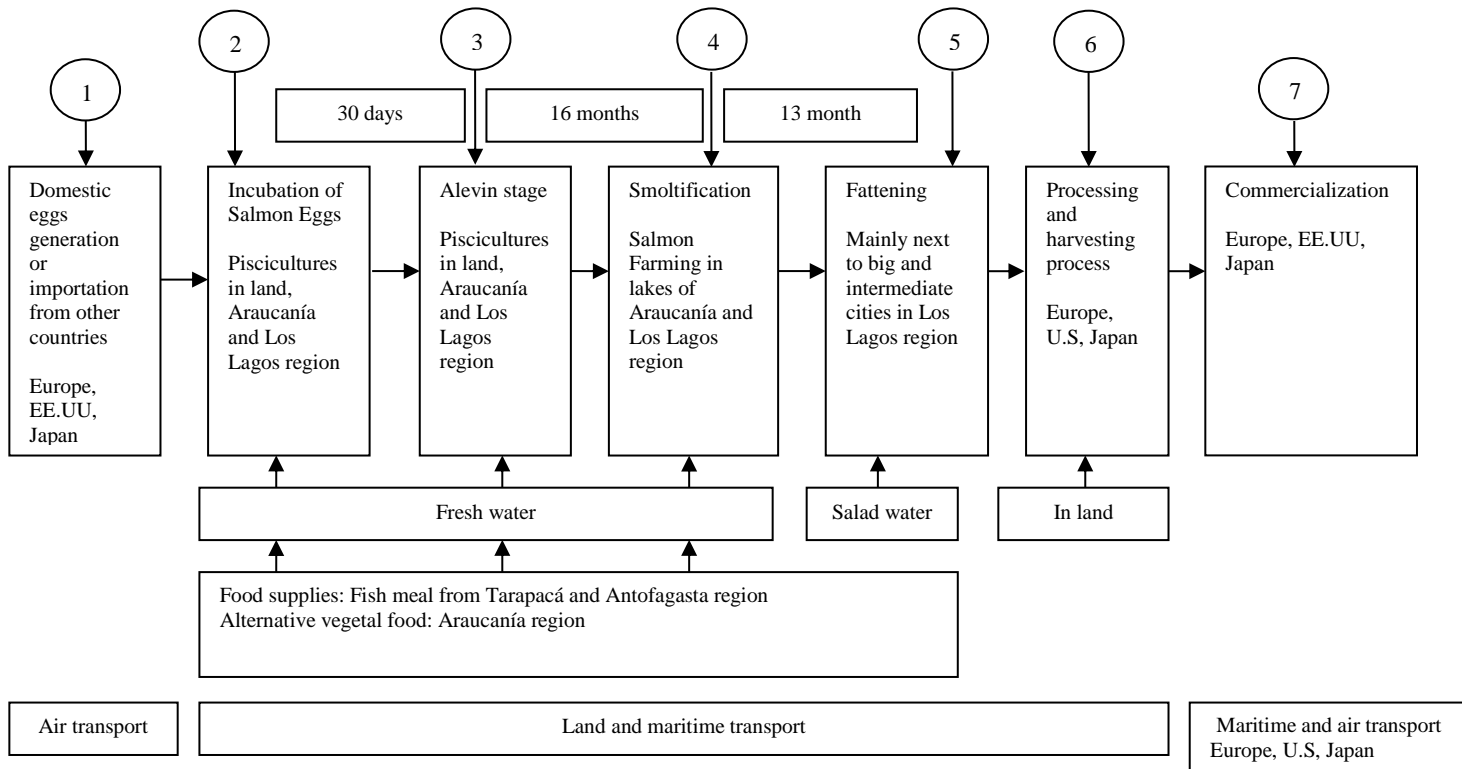
Source: Own Elaboration

Thus, the mesoscale analysis (regional) refers to operations that are developed specifically in the Los Lagos region and correspond mainly to the installation of floating cages in lakes and marine waters and further processing of the product. On this scale the role of the city of Puerto Montt is also considered as a regional administrative centre of the salmon industry companies. Finally, on a macro-level, other Chilean regions involved in the productive process of salmon are considered as providers of food for salmon (I, II, VIII and IX region) and in an international context, countries where salmon produced is exported to international markets, culminating with this stage the chain of production of this activity.

4. Characterization of the Salmon Industry Productive Process

Figure 6

Functional Organization of Salmon Industry productive process in Los Lagos Region



Source: Own Elaboration

a. Eggs: Importation and National Production

The production of eggs for culture comes from artificial fertilization between male gametes and spawning females. During the decade of the 1990's the majority of the eggs were imported from Norway and Scotland. However, initial attempts to reduce this dependence on European countries began when the salmon industry in Chile tried to partially manage their own production of eggs in the period from March to October. With the accumulation of specialized knowledge and new technologies, companies located in Chile overcame this limitation and in fact in 2002 they reduced this basic input to 35%, which is seen as an important achievement in this area, avoiding the importation of diseases transported by eggs and the use of antibiotics. National regulations also promoted the prohibition of the importation of eggs from countries with previous disease problems such as the ISA virus,

in 2005 almost 90% of total salmon eggs required were produced in Chile. According to Kast (2004) in 1994, 114 million units of salmon eggs were imported. However, during the next years this amount decreased, mainly because local egg production was favoured by the important necessity to reduce cost in this productive phase as a reaction to some ISA infection detection of imported eggs and the important increase of investment in local research activities in biotechnology helping to produce salmon eggs in Chile based on advances in photoperiod and temperature conditions of salmon eggs in initial phases.

The increase in local egg production has resulted from improved understanding of the role of photoperiod and temperature in the timing and rate of egg development and growth rates in fry.

b. Incubation and young fish (Alevin) stages (Hatchery Operations)

Once the eggs generated in Chile by the spawning of adult females (or are imported from other countries) are ready to continue the process, they are fertilized and incubated in the laboratory or hatchery facilities and placed in fresh water tanks with re-circulating systems for 30 days. At the end of this period the “egg-eye” is formed leading to the hatching and emergence of young fishes.

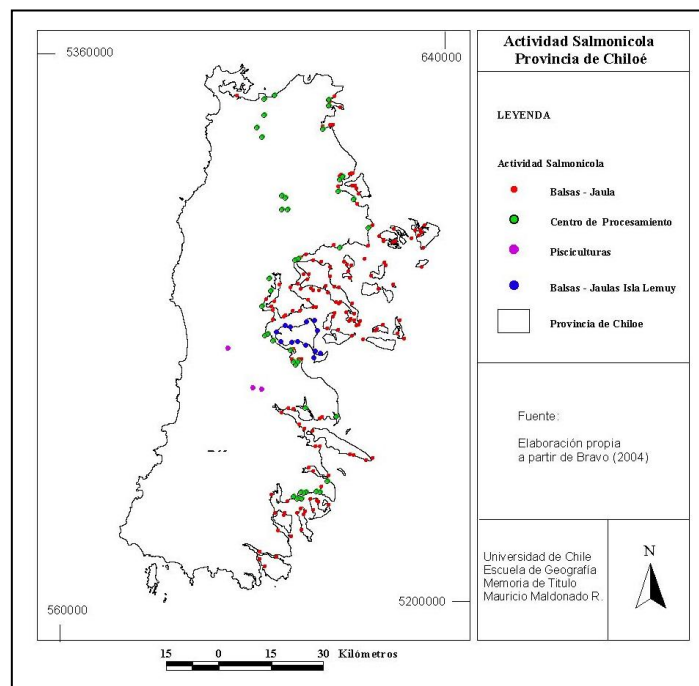
The spawning and young fish stages of the production process are carried out in piscicultures commonly located on “land”. In this phase they are biologically able and adapted to be transported to freshwater in lakes where the process of smoltification begins. The locations of piscicultures are commonly linked to the proximity and connectivity and transport conditions where the smoltification stages are carried out. Since the transport of young fish to fresh water farms is very delicate and complex, this process requires an important utilization of technology management and logistics. In recent years advances to mitigate environmental impacts of water that is used and released in this phase have been also important for reducing nitrate or phosphate levels.

c. Smoltification, fattening and harvesting

After 16 months, the young fishes turn into smolt and weigh approximately 80 grams. They are transported by land in trucks specially equipped to maintain minimum natural conditions (i.e. oxygen) reducing mortality. After that, smolts are transported by special ships and stocked into the floating cages. Despite market demands, natural conditions and manage practices may change among companies and particular locations; they spend approximately 13 months reaching a weight of approximately 4 kilos, a period that finalizes with their harvest with the help of wellboats.

Figure 7

Example of Salmon Farming localization in Chiloé Province, Los Lagos Region



Source: Own Elaboration, 2005

The floating cages (20 x 20 meters approximately) are enabled with automated feed systems, sensors and security systems and are located in concession of each company and distributed in the coast of Los Lagos region with some concentration areas such as the island of Chiloé in the southwest side of the region. Important management control systems and software have been implemented to increase productivity and reduce labor costs.

Coho salmon is produced in Chile during the period of October-January, when there are not direct competitors producing and catching wild salmon.

d. Salmon Processing

Salmon harvested in the floating cages are transported by sea and land to the processing centres located on land. In this stage, the cleaning process and disinfection is carried out which changes depending on how the product is expected to be exported. Differentiation and added - value process is also generated, transforming the product into salmon fillet, chilled fresh salmon, smoked salmon, dried and salted, canned salmon and prepared meals, among others. In this phase specific skills of employees, good equipment and technologies are very important for maintaining high qualities of the products and standard requirements in terms of cold chains, colour, size, and packaging.

The cost of labor in Chile is lower than that in competitors such as Norway and Scotland. For this reason, processing facilities in Chile employ almost twice as many workers as equivalent facilities in developed countries. This gives Chile a comparative advantage in labor-intensive activities that cannot be automated, such as the production of fillets and the boneless portions of salmon.

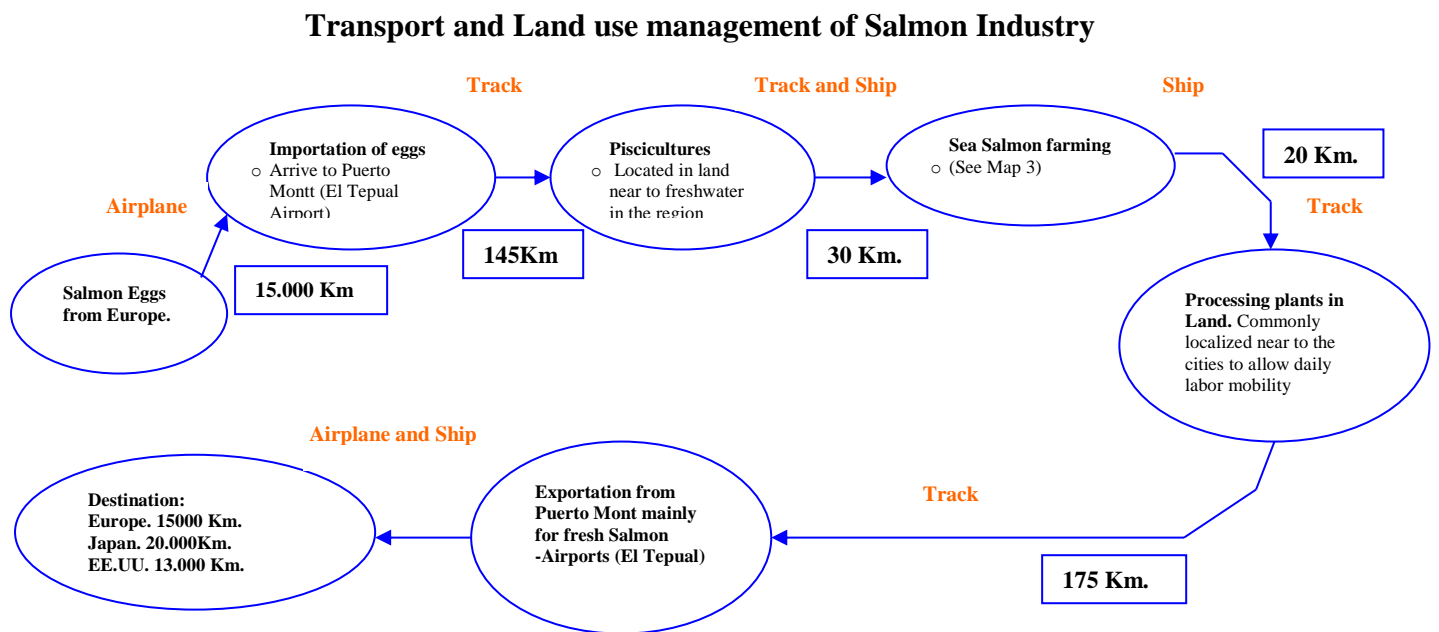
e. Commercialization

Finally, after the product leaves the processing plant it is ready to be marketed and exported through ports and airports in the Los Lagos Region based mainly in the city of Puerto Montt. The way to be transported to end markets is linked to the type of product. For example, fresh salmon fillet must be brought to international markets by air to maintain their properties and organoleptic characteristics, while canned salmon preferably transported by sea. In this phase logistic systems, transportation management systems and coordinated efforts are very important to access market destinations in required period times according to international regulations.

5. Transport circuit in the Salmon Industry production process

The existence of different transport flows (featured by different content and direction) generated by the salmon industry productive process has resulted in the creation of specific inter-sectoral and inter-spatial regional dynamics.

Figure 8



Source: Own Elaboration

These flows can be seen as a circuit of transport with a specific spatial component because of the different functions and links in the value chain occupying a delimited geographic space and allowing the visualization of specific elements and territorial relationships in the spatial organization of the salmon industry in the region.

As it was noted before, this activity in addition to being favoured by the classic factors of spatial location (such as the demand for marine space and land in the production process), economies of scale and agglomeration acquired by its cluster features and amounts of production, is favoured by transportation costs because the majority of the productive process is spatially limited to a regional scale. However, since the case of export and marketing stages in the productive process is mainly international, it is important to analyse this process using a macro scale analysis.

It is important to note that each stage of production is related to a specific transport (plane, truck, boat and mixed) depending on the distances, time required to optimize the production process, the technical requirements of the products and specific geographical conditions.

The spatial organization of transport in the Los Lagos region has a centrifugal character, meaning that the infrastructure and flows are focused directly to the export points (ports and airports), where all the flows that are materialized in other areas are terminated, assuming the form of “fan”, which reaffirms the relationship of producer / port-airport (Apey, 1983).

This territorial dynamics at communal, regional and international levels have specific networking and flows that can be classified and identified according to their direction and content. Certainly, in that sense it is possible to affirm that the characteristics and evolution of the transport and connectivity of companies and public and private road infrastructure, airports and ports have greatly advanced. It must be remembered that this activity bases its operation on the effectiveness of transport, the density (quantity) and quality of road infrastructure, as well as the quality of transportation and travel routes, minimizing the time-cost of transport. This feature has greatly contributed to the development and productive efficiency of the salmon industry.

Table 7

Maximum distances involved in the Chain Production of Salmon in Los Lagos Region

Distances(Km)	Stages
16.000	Importation of eggs from Europe
20.000	Exportation to Asia (i.e. Japan)
3.000	Acquisition of food supplies from Northern regions of Chile
370	Transport of eggs- smolt-sea farming

Source: Own Elaboration

According to Table 16, taking the city of Puerto Montt in the Los Lagos region and the area of influence involved in the productive process of salmon as a reference point, the distances would add up to a total of 39,370 miles travelled.

Moreover, the accessibility and connectivity is also presented as a positive point location in the Los Lagos region. The infrastructure that supports land, sea and air transport has greatly reduced the friction distance, time and costs, promoting access to all phases of production and markets of destination.

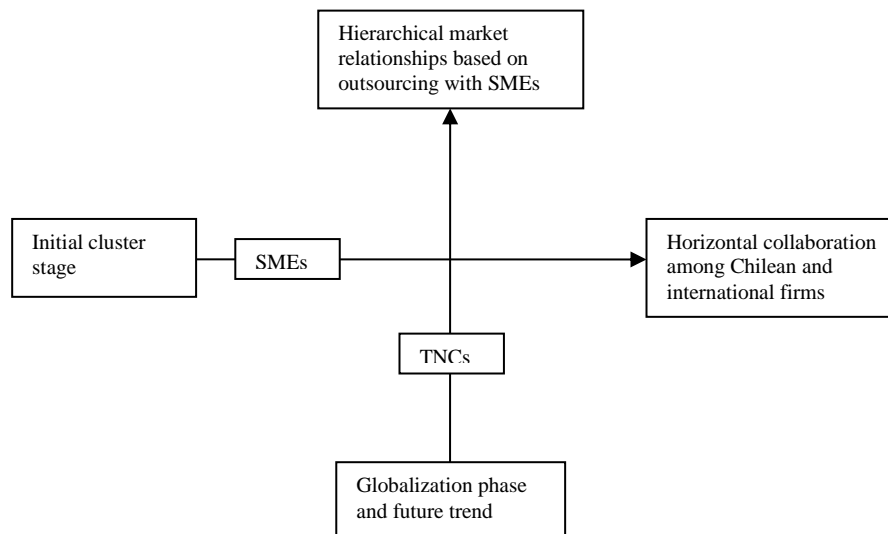
6. Governance and Structure of the Salmon Cluster

Maggi (2002) considers a value chain analysis of the salmon industry that takes into account collective efficiency, innovative patterns and governance structures based on collaborative efforts to explain the high competitiveness of the Chilean salmon cluster. He argues that external economies in the Los Lagos region are closely linked to the increased generation and arrival of skilled human resources, entrepreneurs and also local labor highly familiarized with fisheries activities. On the other hand, since the beginnings of the activity, a flexible legal and economic framework has supported entrepreneurial initiatives conforming coherent regional institutions.

Perez-Aleman (2005), considers that the generation of a cluster based on comparative advantages in developing clusters is not necessarily linked to the creation of external positive effects. On the contrary, the author underlines that the dynamics and evolution of the Chilean salmon cluster have permitted the emergence of strong institutions allowing coordinated public-private learning processes. These cluster characteristics have stimulated systematic improvements of the organization capabilities and catching-up firm mechanisms, allowing access to international industry standards and thus demanding systematic technical innovations to produce high quality salmon products.

In the same context, Maggi (2002) argues that with the evolution of the salmon cluster, governance structures have tended to generate quasi-hierarchical market relationships based on outsourcing with SMEs and headed by TNCs.

Governance Structures of the Salmon Cluster



Source; Based on Maggi, 2002

Maggi (2002) also stresses the importance of associability and collective organizations of the salmon cluster. Salmoexport, Intesal, Salmonfood are only some of the organizations that are the result of associative initiatives. These organizations have generated, at the same time, associative programs with the public sector and universities in order to increase the quality of the product and the sustainability of the sector, open new markets, develop sectoral linkages, training and formation programs. Other crucial elements promoting the positive development of the salmon cluster are technological learning, local specialized training formation and the development of local suppliers.

According to Fernandez and Briones (2005), Maggi (2003) has argued that the competitiveness of the salmon industry has been based on the collective capacity to organize and generate collaborative networks at regional, national and international levels. Important national industrial associations from the beginning of the salmon industry evolution such as “Salmonchile” created to have access to new markets, have been a key factor to the development of the industry. On the other hand, technological learning has permitted an increase in the efficiency of specific problems and procedures of the salmon productive process gaining more skilled employees and know-how by technological missions or international experts with the support of public investments.

Throughout the entire production process products and services have been incorporated that are increasingly provided by regional firms. Recently, an important number of more skilled and professional employees in aquiculture supported by government training programs and incentives (by tax deduction for example) have been trained in regional universities and research institutes (Universidad Austral in Valdivia and Universidad de Los Lagos) in order to match the offer and demand of the labor salmon market that increasingly has needed more specialized labor to improve efficiency and competitiveness. All of these factors, regional efforts to generate more applied research and new technologies, have allowed the reduction of costs in the salmon productive process. According to Quiroz (2006) in Vera (2006), the total R&D expenditures of the Salmon Cluster in the period 1990-2006 reached around US 76 Million; 49.8% were from public funds, 43.2% were from private firms and 7% were from INTESAL.

Considering the period 2007-2009, the ISA crisis (a viral salmon disease that caused the ceasing of 60% of the cultivation centres) has caused important damages to the salmon industry production. It is mainly due to the high concentration and over-exploitation of salmon production that not only affects the region but increases the industry's vulnerability. The non-collaborative, hierarchical and "free" cluster scheme of the salmon industry, allocated in the south region of Chile, has shown to be insufficient to prevent the ISA crisis (Katz, et al, 2011).

It is possible to identify specific regional actors such as government agencies, research institutions, salmon firms and the emergence of new entrepreneur initiatives in areas such as licensing, sanitary standards, regulation, etc., (UN, 2006). The conformation of the salmon cluster in Chile was highly determined by public and private interaction that was initiated by public research programs that a few years later allowed the apparition of start-ups that acquire specific knowledge from public organizations to generate new firms (Perez-Aleman, 2005).

The Ministry of Economy by the Fishing Undersecretary (Subpesca) and the Fishing National Service (SERNAPESCA) carry out law compliance and control. They are also responsible for giving licenses and aquiculture maritime concessions or authorizations to rent, sail or exploit a sea delimited water column from the bottom to the surface.

Concessions are given indefinitely but a development plan for 5 years has to be submitted, and the cost of the license per hectares is US\$64 (Bjørndal and Aarland, 1999).

Bjørndal and Aarland (1999) have noted the lack of transparency in the use of medical and chemical inputs in the productive process and the lack of monitoring to reach industry standards. Universities that are linked with the salmon industry are Universidad de Chile, Universidad de Los Lagos in Osorno and Universidad Austral in Valdivia. INTESAL and the Fisheries Development institute (IFOP) have also become an important centre of Fisheries research in Chile. It is closely linked to CORFO (Corporación de Fomento de la Producción) and SUBPESCA (Subsecretaría de Pesca) and is located in Valparaíso with a regional office located in Puerto Montt. Fundación Chile was the main national organization leading the initial development of the industry during 1980.

It is well recognized that self-regulation and voluntary efforts of private firms to maintain certain grades of sea spaces with low levels of contamination (that is a mandatory variable to the salmon farming), to reduce fish mortality in the productive process and sell higher quality products free of harmful products to the environment and human health while satisfying international standards and customer demands, have contributed to reduce environmental impacts. However, these efforts are not enough nor are public initiatives to generate regulatory mechanisms and monitoring activities in labor and environmental areas.

At national and regional levels, the following public and private institutions in different areas have a direct influence in the salmon cluster performance:

a) **Governance Institutions**

- ❖ **Fishing Undersecretary:** It was created in 1976. The organisation manages public funds for research and technology developments. It provides financial resources for the FIP (Fondo de Investigación Pesquera) in order to advance in the area of control and monitoring research. Different organizations have access to these funds: universities, Fundación Chile, IFOP, etc.

- ❖ **Fishing National Service (SERNAPESCA):** It was created in 1978. It is a public organization that is administratively dependent on the Fishing Undersecretary. It is in charge of monitoring fishing and aquaculture norms, providing services for their proper execution, and aims for effective sanitary management. It also has to control the sustainability and care of the hydro-biological resources and their environment.

- ❖ **Labor Inspection:** The regional extension of the Labor Agency (Dirección del Trabajo), which is overseen by the president through the Ministry of Labor and Social Prevision. It is regulated by the organic law n°2 (1967) and n°3 (1981). As a regional bureau it executes and oversees the fulfilment of lawful regulation, establishes prevention and resolution of conflict interventions, defence of fundamental rights, and offers technical labor aid and certifications.

- ❖ **Regional Agency of Maritime Territory Concessions (DIRECTEMAR):** The regional extension of the Agency of Maritime Territory Concessions, which was regulated in 1953 by the law enforced decree n°292. Later, the “Navigation Law” came to replace it increasing its field of action, including maritime ecology preservation. Its current major functions are to protect human life at sea, protect the aquatic environment and marine natural resources, and to regulate the activities and compliance with laws and international agreements.

- ❖ **Environment National Committee (CONAMA):** Headed by CONAMA, the “Acuerdo de producción limpia” from 2002 (clean production agreement) involves around 10 public institutions and 50 private firms with the aim to increase clean production and reduce contaminant impacts of salmon activity.

- ❖ **Coastal Use Committee:** A multi-ministry organization created in 1994. It is in charge of proposing to the President a set of actions that promote compliance to the national policy of coastal use. Its primary functions are: to propose a zoning (according to use) of coastal space, to elaborate reports of the national policy implementation, to propose changes in policy and territorial alignments towards further coherence among the two, to mediate discrepancies, and to coordinate initiatives of national and regional scale. The committee is presided by the Minister of National Defence, and integrated by: the Sub-secretary of Military Forces,

representatives of the ministries of: Planning, Public Engineering, Urbanism and Housing, Telecommunications and Transport, Environment, and National Patrimony, representatives of sub-secretaries of Regional and Administrative Development, Fishing, and representatives of the National Military Forces, and the National Tourism Service.

- ❖ **Los Lagos Regional Government:** Allocates important funds to implement infrastructure to the Industry's development. Resources are implemented by municipalities, SERNAPESCA, etc.

b) Support Institutions

According to Montero (2004) in 2000, there were competitive funds in aquiculture for a total amount of US \$10 million. Around 70% were public funds and the rest was provided by the private sector.

- ❖ **Chile Foundation:** It was created as a public organization in 1976 by the Chilean government to generate new resource-based companies. It has been crucial to the development of the Aquiculture sector in Chile introducing foreign technologies to domestic firms. Some leading firms were conforming to demonstrate technical know-how and commercial opportunities in the salmon industry to other Chilean firms. Salmones Antártica was the first large scale farming company. Fundación Chile was the pioneer in generating research activities and giving technological assistance and diffusion to new producers thus stimulating thus the generation of new almon firms mainly in the feeding and processing stages. Other firms created were Salmones Huillinco S.A, Salmotec S.A, Finamar S.A. Once firms have established themselves in the market they are sold to the private sector (UN, 2006).
- ❖ **Production promotion Agency (CORFO):** A public agency focused on new business opportunities, industry innovation, and scientific and technological development. It promotes private-public cooperation and associability with universities and other regional agents. It allocates funds for research development

through competitive funds such as FDI aiming to support precompetitive projects in R&D and implemented by IFOP, INTESAL, etc. FONTEC is also a competitive fund that promotes innovation in firms.

- ❖ **Integrated Management System (SIGES):** Program composed of 25 firms with the aim of regulating and standardizing productive systems of the salmon firms focusing on fish sanitation, environment and labor aspects. Traceability is not yet a public requisite.
- ❖ **CORFO and Salmonchile** have led the project “Salmoncluster” in the context of an Integrated Territorial Program that has been generated in order to increase the efficiency of public and private resources focused on the salmon industry.
- ❖ **Fishing Promotion Institute (IFOP):** Non-profit research institute created in 1965. It is focused on technology development and sectoral analysis becoming crucial to the generation of public policies (UN, 2006).
- ❖ **Regional Secretary of Planning and Coordination (SERPLAC):** Generates different instances of coordination between regional and national institutions, programs, and agents, in the form of committees, dialog tables and working tables. Some of them are: Regional technical committee for Labor and Income, Regional technical committee for Education, Regional working table “Chile grows with you”, and the Regional technical table of “Bridge Program”.
- ❖ **National Fund for Scientific and Technological Development (FONDECYT):** The main fund of its type in the country. It was created in 1981 and promotes the development of scientific and basic technological research. It provides financial support for individual research in all fields of knowledge and different stages of a researchers’ career.
- ❖ **Fund for Support to Scientific and Technological Development (FONDEF):** Created in 1991, it aims to contribute to the national economy’s competitiveness, and improve networking among research institutions, firms and other institutions in the development of applied research and technological development of productive

interest. It mainly consists of direct funding towards R&D and emerging entrepreneurial development.

- ❖ **Agricultural Innovation Foundation (FIA):** A support agency for innovation, dependant on the Agriculture Ministry. It provides funding, knowledge and assistance for the development of innovation initiatives. In 2013 it supported 203 initiatives, including informative tours, consultations, projects, innovation studies, Territorial Innovation Programs (PIT), Technological Consortiums, and Technological Development Programs (PDT).

- ❖ **Exportation Promoting Agency (PROCHILE):** It depends on the Ministry of Foreign Affairs and has as the main mission of supporting domestic exporters to have access to international markets, designing high quality information systems and special programs to increase export skills in firms, commercial alliances and also supporting firms to participate in international fairs. It provides regulation and data information about export destinations and commercial trends. Prochile has 56 offices around the world and 15 national offices to identify the main export opportunities helping to develop and implement trade and export promotion strategies.

c) **Research Institutions**

- ❖ **Ministry of Economy's Fund for Fisheries Research (FIP):** Focused on environmental conservation of aquiculture, created in 1991 by the general fishing law. It is managed by the Fishing Research Committee, presided by the Undersecretary of Fishing, and integrated by the president of the Oceanographic National Committee, and six other specialists in the fishing field, appointed by the President. Its main functions are to establish the annual priority research areas, to assign research projects and their funding, to sanction technical qualification of research projects, and to elaborate and communicate the annual memoir of activities.

- ❖ **Technological Salmon Institute (Intesal):** It was created in 1984 by Salmonchile as an important private research organization focused on technical assistance and

training. It has as a mission to identify the main technological industry requirements, generate technological advances in the area of food, sanitary and control quality standards such as waste treatment and management systems and firm international standard certifications thus promoting the cluster competitiveness and acting as an information source to policymakers. In 2006, the alliance with SENCE (Servicio Nacional de Empleo y Capacitación) permitted the conformation of an important training platform mainly in the area of control management (UN, 2006). Headed by INTESAL and financed by CORFO, the main objectives of the “Programa Territorial del Cluster de Salmón (PTI)” (Territorial program of Salmon Cluster) are linked to improving efficiency of public funds to increase competitiveness of the value salmon chain, new business opportunities and advance in regulatory aspects. INTESAL also leads a technical meeting called Comité Técnico de Salud (technical Committee) where salmon producer firms and laboratories socialize main collective industry problems and solutions.

- ❖ **Association of Producers of Salmon and Trout (Salmonchile):** It is a private association created in 1986 with the aim of representing the salmon industry firms in Chilean institutions and abroad. Called Salmonchile since 2002, it has ensured updated sectoral information to salmon firm members (42 firms with 85% of total production) and permitted access to international markets and customers. It also defines, coordinates and certifies industry quality standards in the salmon industry, regulation proposals to national authorities in order to increase industry efficiency through sectoral public policies and also represents salmon firms in international instances.
- ❖ **Regional Association of Armoury and Maritime Services (ARASEMAR):** Founded in 2001 in the Los Lagos Region. Their associates mainly include the Llanquihue and Chiloé provinces. It promotes rationalization for the proper development of the common activities of its members coordinates activities, and it represents the common interests of its members to third parties and government institutions. It currently entails 15 active members, with 99 total ships.
- ❖ **Universities:** Universidad de Chile, Universidad Católica de Valparaíso, Universidad de Los Lagos in Puerto Montt, Universidad Austral de Valdivia and

Universidad Católica de Valparaíso in the Valparaíso region, Universidad Andrés Bello from the Metropolitan Region and Universidad Católica de Concepción, from de Bio Bio Region.

According with to Boisier (2011), universities execute research projects mainly as the result of specific consulting projects that are requested by private firms to academic professors of universities or also as academic initiatives focused more on generating new knowledge than to develop applied research to solve specific salmon industry problems. Universities offer technical and professional carriers in the area of aquiculture administration, biochemistry, etc.

- ❖ **Scientific and Technological Research National Committee (CONYCIT):** It allocates competitive funds for research and technology development, such as FONDEF, focused on public-private cooperation to R&D initiatives.
- ❖ **Training and Employment National Service (SENCE):** In 2005 there were 1,866 training actions carried out by SENCE for the salmon industry with a private-public investment of US 1.8 million (Vera, 2009). Salmon firms frequently use tax exemptions to have access to training programs in specific areas of the industry in order to count on more skilled employees. Also some companies have made efforts to raise the educational levels of employees. Around 800 employees in the period 2002-2004 participated in these programs (Montero, 2004). Different organizations conduct training services in specific areas, some of them designed especially to supply specific necessities of the private salmon firms.

7. Cost Structure and Competitiveness of the Salmon Industry

Despite has been shown that in 2002 and nowadays the productivity in Chile is quiet lower than Norway, taking into account the use of workers to produce 1 Ton of Atlantic Salmon, in 1999 the cost to produce one kilo of Atlantic salmon in Norway was around USD 0,50 cents more expensive than in Chile (referential range of price of 1 kilo in 1999; USD \$2,02 and \$3,10) (Bjørndal and Aarland, 1999). The main variables used to compare cost of

production were eggs, transportation, feed, labor, harvesting, processing and packaging. However, recently the research produced by the Transnational firm Marine Harvest, one of the most important salmon producer firms in Chile, has shown that the cost of salmon production is 14% more expensive in Chile than in Norway (Marine Harvest, 2015). This

Traditionally, the main comparative advantages for Chilean salmon production are attributed to feed and labor cost. However, Bjørndal and Aarland have shown that labor costs in Norway are only 10% higher, mainly because despite unskilled labor being quite cheap in Chile, operational staff are quite expensive, equilibrating the costs in salaries in Chile and Norway where salaries of all production chain are more equitable. However, according to the UN (2006), labor costs, in general terms, are lower in Chile than in developed countries.

For example, in the processing phase in Chile twice as many workers are occupied than in Norway and Scotland, becoming an important comparative advantage especially considering labor-intense phases. On the other hand, the difference of feed cost to produce one kilo of Atlantic salmon was also quite reduced: USD \$1,210 in Chile versus USD \$1,263/kg in Norway. Despite the reduced cost differences between a young Chilean salmon industry and a more mature Norway industry, Chile still has possibilities to reduce cost, mainly considering variables such as feed local production, new infrastructure possibilities, new and more efficient logistics and management procedures, reduction of Salmon mortality, etc.

Table 8

Number of Firms and employees in the Salmon Cluster

Subsystem	Industry	N° Independent firms	N° Integrated firms	Total	Estimated employees (2001)
Core of the productive chain	Hatchery	5	19	24	4000
	Pre-engorda (lakes)	10	31	41	9500
	Floating cages	9	31	40	14000
	Processing	6	18	34	1000
	Subtotal	30	36	66	28.500
Direct supply-firms	Feed	3	2	5	800
	Equipments hatchery	50		50	3300
	Pharmaceutics	20		20	900
	Process equipments	30		30	3200
	Packaging	12		12	1000
	Harvesting, transport and maintenance	30		30	3300
	Subtotal	145	2	147	12.500
	Total	175	38	213	41.000

Source: Maggi, 2002, from SalmonChile, Sernapesca y Aguilar, A. (2002); Infante (2002) and Vidal (Cepal, 2002)

According to Maggi (2002) almost 75% of total Chilean salmon employees are low-skilled laborers; there is a ratio of 1/6 between technical labor and professionals, which is the opposite of Norway where the ratio is 6/1. Malerba and Mani (2009), have stressed in this way that the salmon industry in Chile is a low-skilled, labor intense industry.

Fernández and Briones (2005) carried out an interesting study of the costs of the productive process of the salmon industry that concludes that the competitiveness of the sector in Chile is mainly based on lower productive costs becoming structural comparative advantages. They have estimated that the difference to produce one kilo of Salmon is US\$ 0,33 lower than direct competitors. Approximately US\$ 0,20 of the difference is obtained in the salad and fresh water stages. However in recent years an increased number of firms have adopted a strategy based on more value-added products. According to the UN (2006) study, during the first hatchery phase 5% of total production costs are spent, 49% in the farming and harvest phase and 46% in the third phase that may be divided into the processing sub-phase (18%) and transport and distribution (28%). According to Vidal (2002), feed accounts for 45% of total salmon production cost and labor accounts for 27%. In this context, it is important to highlight that during the salmon production process (mainly in the smoltification and fattening stages), food for salmon is the most important

critical variable in the cost structure of the industry. Despite the food being mainly based on fishmeal from fisheries located in the north of the country (Tarapacá and Antofagasta Region) feeding also incorporates pigments, medications and vitamins that reduce mortality rates in salmon production. Recently, in order to overcome the observed relative scarcity in the country of fishmeal production and the increased need to use more organic diets reducing colorants and fats, alternative feed production has been considered based on a vegetable flour derived mainly from the production of Lupino, a legume that is produced especially in the Araucanía Region and in the recent years has expanded rapidly reaching in 2004 a total of 28,000 hectares which places Chile as the second place producer worldwide after Australia, a country whose production has been affected in recent years by bad weather, which gives good prospects for the Chilean production (Revista del Campo, 2005).

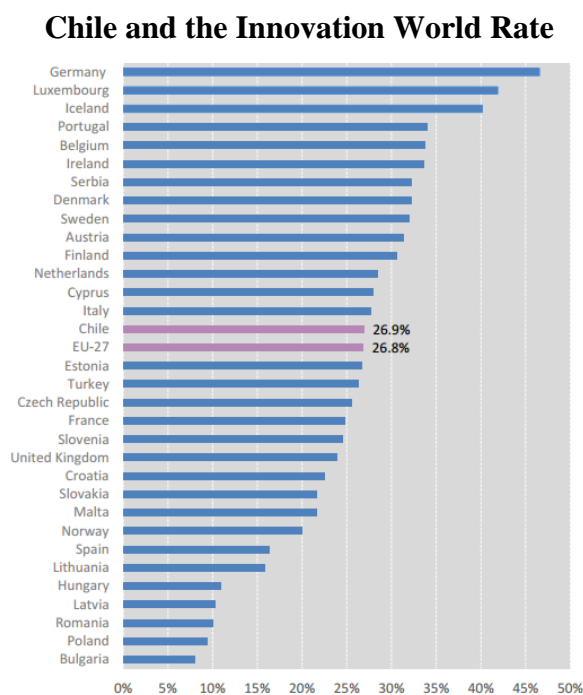
It is also important to stress that currently the Chilean salmon firms present comparatively low rates of bank loans compared to the Norway salmon industry. According to Vera (2009), domestic financing organizations have played an important role in the Salmon cluster. The current bank debt of the salmon industry borders US \$1,6 billion.

Regarding the important distance of final markets, Bjørndal and Aarland (1999) have stressed the necessity to increase transport infrastructure and efficiency of salmon oriented regions. Airports, new ports and roads will permit a reduction in cost and augment competitiveness of the sector.

8. Innovation and R&D in Chile and Salmon Industry

In a recent Innovation Survey, Chile ranked closely to the average rate of world innovation. However, the Chilean productive structure is mainly lead by the natural resources extraction industry featured by low technological development and use of knowledge.

Figure 10

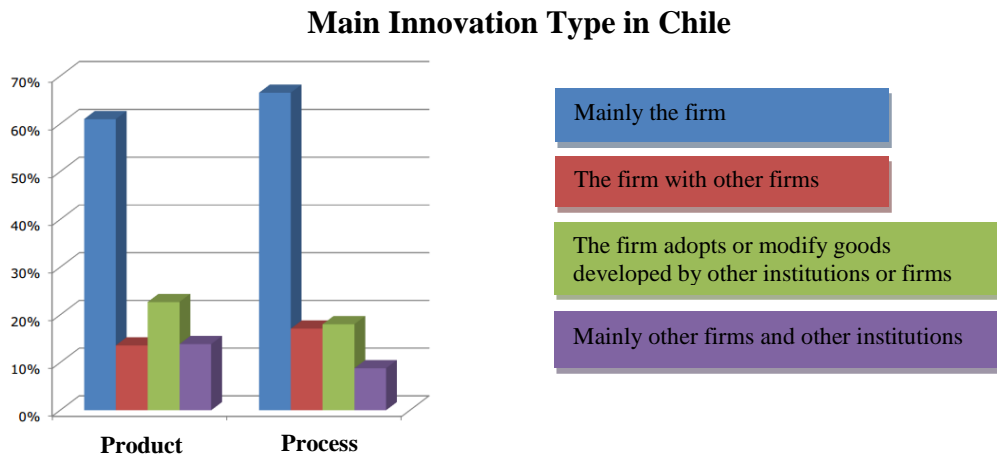


Source: 8th Innovation Survey (2011-2012), Minister de Economic, and Science, Technology and Innovation in Europe, Edition 2013, based on CIS_2010 (Community Innovation Survey).

In this context, those industries are more focused on efficiency than in systematic innovation. Expenditures in R&D reach only 0.35% of the GDP, while the OECD average is 2.4%.

An examination of the Chilean innovation rate by sector shows that “Fishing” in 2013 was the sector with the third lowest rates of innovation. Within the fishing sector, innovation in production only amounts to 4.3% of the 16.5% total rate. Obviously, the fishing sector can still be featured by low rates of innovation since it is related to an extractive sector and the exploitation of natural resources.

Figure 11



Source: 8th Innovation Survey (2011-2012), Ministerio de Economía, and Science, Technology and Innovation in Europe, Edition 2013, en base a la CIS_2010 (Community Innovation Survey).

Another significant and shared characteristic of innovation within Chilean sectors is its low level of cooperation and integration of sources, funding, knowledge and institutions; what seems predominant instead is a rather individual and isolated type of innovation developed by firms on their own.

Christensen et al, concluded (2000) that some low-tech industries can develop substantial innovation activities, based on internal stimuli. In their report, around 23 percent of the 640 firms surveyed had product and/or process innovation, and 24 percent had other types of innovation. Firms delivering directly to end-users were more likely to be innovative than those delivering to the processing or wholesale links of the value chain. Many of the innovative firms had no collaboration on innovation, hence respondents generally claim that stimuli for innovation were primarily internal. The authors also pointed out that this situation was supported by a very well-developed extended knowledge base, which is a vital source of information and knowledge for innovation. What we can take from these studies is that associability and collaboration between firms, and external demand, are not always necessary in order to generate innovation processes within firms, but in exchange, for these type of innovation to take place, a broad base of knowledge, available and fluid, does appear to be mandatory which is not the case for the Chilean salmon cluster.

Lisuka, (2004) has stressed the organizational capabilities and external environment of salmon firms in Chile as increasing trade performance. Lisuka, (2006) studying salmon firms, analysed levels of standards and compliance of the firms using the following variables: external influences (export, foreign capital), vertical relationships (collaboration with client), horizontal relationships (collaboration with suppliers), absorptive capacity (years of operation, number of professionals, past experiences such as quality standards) and collective capabilities (membership of association). Considering firm-level capacity and more collective capabilities, the conclusions suggest that more absorptive capacity and membership in associations raise the standard firm levels of compliance. However, regarding global and local standards, collective actions such as Industry Associations of the salmon industry appear to be more important than firm-level absorptive capacity.

The specific and more crucial technological advances made for the salmon industry, headed by Universities, private sector and public sector, are presented in Table 5:

Table 9

Main Innovations in the Salmon Industry

Alevin stage (more Technology- based phase)	<ul style="list-style-type: none"> • Infrastructure and devices to the incubation stage • New Filters and photoperiod used in fresh water to maintain production during the year • Eggs domestic production
Fattening	<ul style="list-style-type: none"> • Salmon Feed diets based on vegetal proteins and automatic feeding systems (feed components allowed to increase the conversion rate in Chile of Kg of meal per Kg of fish, from 3:1 in 1980 to 1,3:1 in 2005 (UN, 2006) • Automatic feed systems and software • Dimensions and material of Cage-floats like PVC • Wellboat, boat to transport live fish to processing facilities reducing lactic acid of salmon • Counting and extraction new procedures • Vaccination to control infections and diseases with lower environmental impacts (of hormones, drugs and antibiotics) • Salmon pathogen genomes • Sensors to have information about feed levels and feed requirements • Monitoring environmental systems • Blowers; hoses to transport feed from storage areas to floating

	<p>cages</p> <ul style="list-style-type: none"> • Waste treatment produced under the Cage-floats • Biomass estimators in cage –floats • Antifouling paint to cage –floats
Harvesting and processing	<ul style="list-style-type: none"> • Machines to turn off the fish skin, spines and filleting machines
Commercialization	<ul style="list-style-type: none"> • New logistics and management software to distribution delivery • Land (truck) and sea transport systems • Export and Market intelligence and commercial alliances • Traceability, labelled, certification ISO 9000 de calidad y 14000 medioambiental en plantas de proceso. Acuerdo de Producción Limpia (PL). • Plants have to meet United States Food and Drug Administration (FDA) standards and the Hazard Analysis and Critical Control Point Protocol (HACCP) on food safety developed by Codex Alimentarius.

Source: Based on Lisuka, 2004, Mundo Acuicola, 2015, Revista Aqua, 2015

R&D initiatives and innovations in the salmon industry have been mostly guided by legal environmental regulations and market international quality standardizations, biotechnological advances to reduce the emergence and diffusion of new pathologies and minimize costs in the productive process. In order to reach those high levels of technological advances, associability and public support have been mandatory.

The largest expense on R&D is still made by the firms and thus motivated by their own individual agendas. The Research & Development Personal and Expense among salmon industry Firms Survey (2009-2010) showed that in 2010, 92% of the expenses in R&D were made by the firms, while only the 8% was made by public sector.

The survey also shows that the expense by the firms is fairly common, and that the increase of capital expense is due to the acquiring of buildings and land, rather than instruments or software. On the other hand, most of the ordinary expenses of R&D made by the larger firms, the exporting ones, are destined to Basic Research rather than Applied or Experimental Research. Meanwhile, the smaller and service providers firms, such as food producing and laboratory, expend more on experimental research.

According to the UN (United Nations, 2006), the salmon industry across the world faces a lot of challenges:

- To advance in the generation of technologies to reduce environmental effects of the activity such as vaccines, drugs, waste management, recycling
- To increase efficiency and productivity of the activity, reducing costs
- To increase social corporate responsibility and mitigation plans to reduce impact in social and ecological sphere
- To advance to reach international standards and regulation in the medium-term.
- Become a clean industry
- To diminish fish pressure captures to feed production
- To reduce higher concentrations of fish mass in cages to reduce disease contagious
- To increase regional networks and become a world pole of innovative salmon industry technologies, becoming more pioneers in new technologies generation than technology adopters
- To advance to the conformation of a Regional Innovation System characteristics based on institutions and innovative firms and regional agents
- To incorporate new actors in the value chain and linkages with innovative hotspots, skilled professionals, universities in Chile and abroad
- To increase collaborative and interaction initiatives among public and private organizations
- To increase ethics, treatments, salaries and contracts arrangements with Salmon workers, especially with less skilled workers
- To increase monitoring, private and public control in all the phases of the productive process and also when companies stop working at specific concessions to take responsibility of post-term impacts of the production process (abandoned cages)
- To increase domestic demand and markets of salmon products
- To increase applied technology
- To increase efficiency of laboratories and finance support institutions, R&D projects
- To increase information and knowledge transference
- To instances of knowledge transference, specially from TNCs to domestic SMEs

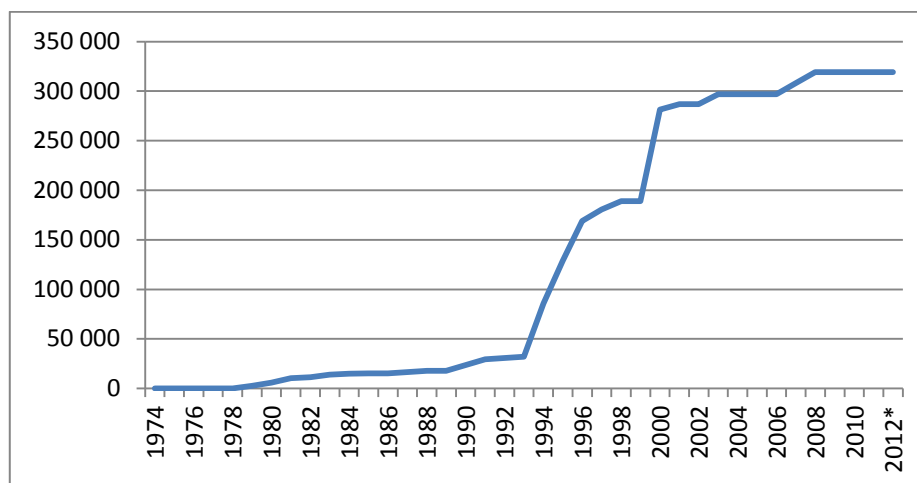
- More specialized and innovative domestic SMEs to maintain market share in specific activities in the future

The UN organization has carried out interesting research about the global competitiveness and innovative performance of the salmon industry in Chile and underpinned the importance of technology transfer and diffusion in order to allow the country to be included into the global economy. Besides the natural advantages of Chile, the study stresses the scientific and technological efforts and advances adding value to resource based industries.

The process of consolidating the industry has been a 20-year process of collective learning and essay-error-solve initiatives and evolution. However, the sector has resorted to importation of international knowledge acquiring and absorbing (or just imitating) new technologies since its first attempts to develop the salmon industry by itself. In the process, important specific domestic technologies and technological capabilities to cover particular Chilean conditions have been upgraded and developed by private and public organizations, which was a positive result. The entire national and regional system and other public organizations have systematically promoted the generation of new firms and the internalization and diffusion of specialized knowledge and skills creating also institutional rules and a critical mass committed to increasing competitiveness and innovation performance of the salmon industry. In this context, important innovative networks have been developed among regional, national and international agents (United Nations, 2006).

Around \$330 million dollars have been invested between 1989 and 2014 by Foreign Direct Investment (FDI), playing a crucial role in the incorporation of new technologies, vertical integration and increasing the size of firms. Once the industry showed interesting signals of evolution and growth, the increase in FDI in services and salmon production in the salmon industry in Chile were mostly attracted by low Chilean tariffs and special subsidies to invest in Chile from 1980 (see Figure 3).

Cumulative FDI in Fishing and Aquaculture in Chile 1974 - 2012
(In nominal US\$ thousand)



Source: Chile Foreign Investment Committee database (2015)

These FDI were generated mostly by multinationals through the acquisition of national firms, firm-merges with national firms, joint ventures, etc. The incorporation of new global players permitted access to new technologies and machinery (mainly from Norway and Scotland), new operative and management systems, back office processes, etc. All of these processes have turned Chile into the second largest exporter of salmon in the world, contributing to the reduction of regional poverty (the poverty index was reduced from 40% to 13% between 1990 and 2000), generate employment (direct and indirect 45,000 employees) and regional economic growth (United Nations, 2006).

New technologies have permitted the simplification of all of the processes in salmon production. In the processing and commercialization stage technologies have allowed an increase in value added products from 23% in 1994 to 69% in 2004 of total salmon exports (UN, 2006). However, these technological advances have impacted the salmon labor market because standardized procedures and automatic machines have replaced labor that years ago were carried out by more low skilled employees.

Thus, there is still much to advance in order to diminish the biological impacts of salmon production, reducing environmental impacts and advancing in new cleaning technologies in all stages of the salmon productive process. Clean technologies, biological salmon

production, and ecological production are some of the concepts that must be incorporated in the development and evolution of the industry, hopefully, with an important positive effect on employment and an increase in the use of skilled labor.

Table 10

Evolution of the Salmon Industry and Support Institutions

	CLUSTER FORMATION AND INITIAL LEARNING		MATURATION PHASE OF THE CLUSTER	GLOBALIZATION OF THE CLUSTER	
	1985 (900 ton) Price: US\$ 9-10 / kg.		1995 (143000 ton) Price: US\$ 4 -5 / kg.	2002 (400.000 ton) Price: US\$ 2,8 - 4,5 / kg.	
	Experimentation phase	Development phase	Industrial expansion	Market expansion	Re-expansion, Industrial concentration and systematic innovation
	1960 - 1963	1974 - 1984	1985-1995	1996 - 2004	2005 - 2012
Government policy	International cooperation	Development of the industry	Positioning the industry in the global market	Seeking new market and industrial sustainability	New environment regulations and re-consolidation of the industry (virus ISA)
Achievements	Technical viability determined Trial-error learning	Demonstration of economic viability. Technological imports and know-how Import and imitation of innovations	Production, technological innovation and trade increases Scale economies. Increase value chain, forward and backward linkages. Outsourcing Industrial organization	Trade agreements with some major markets. Increase productivity and reduce costs, own eggs production	Differentiation and quality of bio-products; hygiene, traceability labelled products, biotechnology advances, international standards, labor improvements. New partnerships and alliances to have access to new markets. Increasing vulnerability Industrial re- organization New national and international brand image of the industry
Major actors	Governments	Government Fundación Chile Foreign firms	Fundación Chile Local producers Government Market	Government Producer (TNCs and SMEs domestic companies) Associations	Government Environmental ONG's Production concentration in TNC
Associations of producer and institutes			APSTC and Intesal formed	Association expand and rename Salmon Chile	Associations

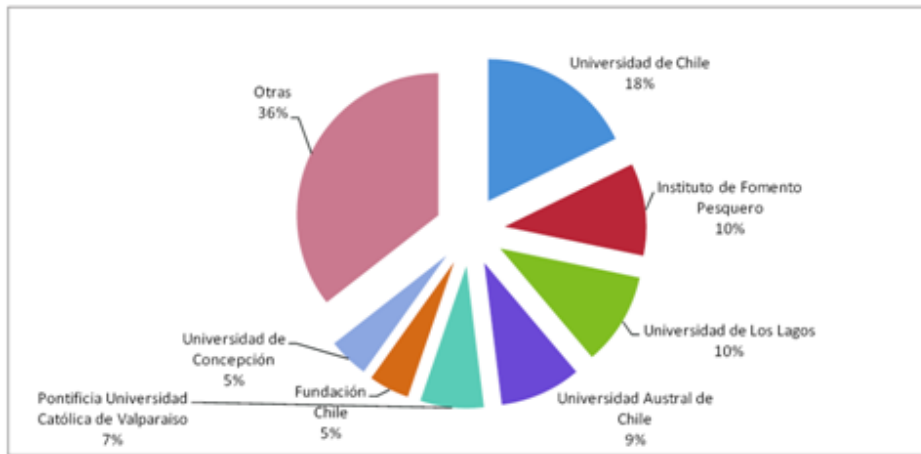
Source: Textually copied, upgraded and adapted from Lisuka, 2004, UN, 2006 and Maggi, 2002

According to Felzensztein, et al (2010), informal social networks contribute to vertical and horizontal inter-firm cooperation (joint ventures, co-branding, market research) in the context of geographical proximity or geographic co-location of SMEs firms in the Chilean salmon cluster. In this context, local face to face communications may become a cornerstone in developing countries such as Latin American countries in order to increase regional institutions and specialized knowledge diffusion (by skilled employees for example) through market and non- market interaction. In the same context, Felzensztein and Eli (2008) have stressed the role of Trade Association in the Salmon Cluster

stimulating social networking and cooperation among firms based on trust and respect reciprocity and confidentiality.

Figure 13

Institutions responsible for R&D projects in Chilean Salmon Cluster (1990-2000)



Source: Boisier, 2011

In the same context, Boisier (2011) underlines the importance of geographic proximity and inter-organizational collective learning of the salmon cluster, in order to coordinate specific solutions to common problems (sanitation problems or standardization processes) that are usually initiated by private firms that socializes specific needs and problematic in a process that adds new agents in a problem-solving sequence. In fact, 152 collaborative R&D projects (biotechnology) among regional public and private agents were carried out in the period 1990-2009. Public economic resources invested reached US\$ 65 million and 43% of these collaborative initiatives were university-firm projects.

Vera (2009) argues that the main factors determining the high competitiveness of the salmon industry cluster are lower costs of labor, natural conditions and the presence of specialized training organizations in the region. Auxiliary economic sectors and technology suppliers have increased the collective efficiency of the cluster highly featured by an important presence of foreign investments, technology transference, collaboration initiatives and innovations.

CHAPTER VI: REGIONAL IMPACTS OF THE SALMON INDUSTRY IN LOS LAGOS REGION

1. Main regional impacts of Salmon Industry

The salmon industry activity extends the productive vocation of the sea to an intensive use of the water as a source of exploitation, a platform into a stage production system that it is integrated with other productive process in land. This is a new type of marine food production, passing from a random fishing operation and regulated largely by natural conditions, spatially irregular and not specifically located in space, to a specific exploitation form based on operating techniques and highly based on a specific geographical location, configuring spatial patterns and a defined spatial organization.

The salmon industry is a highly competitive economic activity based on the exploitation of natural resources which has enabled the incorporation of rural spaces on the globalized world, causing a breakdown of traditional economic structures, creating employment dependence and a strong vulnerability on external factors of the region.

As an example of the impacts of the salmon industry in Los Lagos region, different studies have shown important evidence of its impacts in rural areas, where this activity has an important concentration of salmon farming in its cost and has allowed the emergence of other economic activities related to this stage in the productive process (fattening of salmon). Regarding the study of the active economical population, the results show that the salmon industry has become over the years the main economic engine of communal economic growth (40% of communal employment) and development, restructuring the labor market and gradually replacing the importance of traditional economic activities on the island such as the extensive agriculture and ranching.

The explaining factor of the labor reconversion in this case is the fact that the salmon industry is the main source of paid employment on the island that offers a salary and a stable schedule. That is attractive especially to young people who take the option of working in farming cages leaving the family farms where they have worked as unpaid labor. On the other hand, woman commonly have access to a paid job in processing plants, stressing the division of labor by sex that characterizes this activity.

Through the analysis of the age groups working in the salmon industry, the author detected that young-adult is the group that occupied most work places in the salmon industry. Seventy-two percent of people (both men and women) involved in this activity are within the age group ranging from 15 to 34 years old.

It is precisely in this group where the break occurs: the threshold of change in the socio-economic and traditional labor-linearity of the island. These young people are transforming the economically active population traditionally linked to a micro familiar agricultural exploitation to a new economic vocation linked to paid employment and stable wages generated by the salmon industry which becomes a modern economic activity taking place in traditional rural areas. The impact of salmon farming on young people is unquestionable. In many cases an early incorporation into the labor market involves a

desertion of the educational system, which eventually will mean a loss of alternatives to access to better-paying jobs due lower skills and low educational levels achieved.

This socio economic process has meant that young people are cutting a particular historical and cultural continuity. The salmon industry is thus an activity that has somehow accelerated the integration of the local traditional communities in new forms of employment, which tends to homogenize the working conditions from the proletarianization of the workforce.

Another issue that is emerging from changing the structure of employment in the region, is the high dependency on the jobs that are generated from the salmon industry, mainly due to the lack of job opportunities that are generated in other sectors or economic activities within the region.

It is possible to appreciate that most foreign workers coming to work in the region have more job training and educational skills, accessing jobs that could be filled by workers from the region. Among other factors, this has been the result of the emerging and rapid mechanization and modernization in farming and processing plants, which has demanded a workforce with greater specialization, a process that could be intensified over time.

The development of the salmon industry has reinforced a high dependency of the industry and region on exogenous factors such as foreign TNC concentration, demand fluctuations and prices of salmon products in international markets. These factors have increased important levels of vulnerability of the salmon industry, which also characterizes many export activities.

Moreover, the technical requirements of salmon production are based on the chemical quality of the sea water that has to be free of contamination, increasing the endogenous vulnerability of production in specific over occupied sea areas in the region. The augment of companies engaged in this activity has implied a strong demand for coast spaces in terms of concessions to the location of floating cages where the fattening phase is carried out.

This process has intensified the use of water concessions and has increased the level of pollution that this activity generates resulting in negative externalities that have reduced investment in degraded spaces initiating the relocation of businesses to other areas such as the Aysén region, a situation that would imply a strong social impact because of the high unemployment that this process would generate. On the other hand, the capacity of regional supply firms to participate in the value chain will depend on the capacity to generate new and innovative products, and have access to financial loans and commercial ability to find new business opportunities.

An alternative option for workers to face unemployment scenarios in the region because of the relocation of firms could be overcome if workers are willing to move to new salmon farming facilities in other regions, which would increase interregional migration that has been already generated by intra-regional level because of the salmon industry.

Thus, the salmon industry becomes a factor of population mobility for the region. Although at an early stage this activity is presented as a pull factor of population in rural areas, mainly by new jobs generated from the fattening phase concentrated in these areas, in a second stage it would be operating as a factor of population migration from rural areas to large regional cities mainly due to the lower labor requirements in these production phases and due to new expectations of life that have been learned and initiated by paid labor and which can be projected in a better way in the cities.

The continued decline of rural populations of the region may be due to the emergence of urban-minded and the first signs of acculturation, which would boost the emigration of the population to larger cities, being able to meet the new needs stimulated by modernization processes. As it is possible to see, this abandonment of rural areas has increased progressively, which reinforces the fact that from this activity new expectations of life have been created that are only able to be met in urban centres, associated with greater purchasing power and the new consumer mentality of workers who receive monthly cash incomes from the salmon.

The salmon industry is a link to the Globalization process through the creation of new consumption patterns that have resulted mainly from the access to wage employment and population concentration in urban areas. In this context, the salmon industry orients a new

style of life initiating changes beyond the field of economics because it has also affected the cultural patterns of the population in the Los Lagos region.

Regarding the community scale and considering the location of the salmon farming (rafts-cage) and their areas of influence in terms of population and labor, it is possible to see that labor places have a defined geographic scope since it is common that employees of each salmon farm live in villages or small islands where facilities of the companies are located. The population movements between salmon farms and homes located in coastal villages that are close to the salmon farming are intensified by this employment relationship, expressed in daily migrations between place of residence and employment.

It is also possible to appreciate that firm influence is decreasing from the coast where salmon farming is located to the interior areas of the rural areas; the population displacement from those interior areas to the salmon farms is lower than movements from the coastal villages. In other words, there are more dynamics in coastal areas than in the interior spaces away from the salmon farming. In turn, if the influence of salmon decreases towards the interior areas and familiar productive farms in the region, it is in those places where the customs and cultural traditions of the region are currently retained.

Regarding intra-communal migrations, they are expressed especially in the rural exodus of young people to other regional areas. There is an important reduction of familiar farms due to the lack of family labor to exploit properties, especially this young labor. Despite this process having increased in the last twenty years some families in the region still have conserved their properties in rural zones retaining and preserving cultural characteristics. In this context, small familiar farms have become a cultural expression of traditional values and customs where the primary activities remain that are commonly used as supplemental income. It is therefore possible to assume a deterioration of the features of regional farmers and not a process of total disintegration of the peasantry people within the region.

Another important aspect is the large increase in population that some towns and cities in the region have had. The concentration of populations in small towns that were already relatively structured when the intensive development of salmon farming began, has favoured the development process of these spaces through the provision of basic services and community facilities, which are an extra incentive to attract people from rural areas.

In this sense the salmon industry can be seen as a binding factor, articulating a local culture with a global culture. In this context, in order to understand these complex labor scenarios in the region, the current occupation of the sea should be considered, making it possible to have a complementary vision of the traditional relationship among people, land and time, configuring a new economic geography, oriented to the study of new forms of occupation and organization of space from emerging economic activities such as the salmon industry, which involves both the land and the marine space, giving rise to a geography that relates two elements: land and sea.

In 1994, the Los Lagos region was one of three regions in Chile with the lowest Human Development Index (HDI). Later, in 2003 this tendency remained unchanged. More than half of the region's population lives in districts with high comparative levels of human development. The cities of Valdivia and Puerto Varas show the higher accomplishment in the region. There are, however, nine districts that have a very low index of human development, including San Juan de la Costa which was the national lowest for 2003 (UNDP, "Las trayectorias del desarrollo humano en las comunas de Chile 1994-2003, 2006).

Muñoz (2009) has studied if the salmon industry diffusion has had positive social effects in the Los Lagos region where this activity concentrates different phases of the productive process. The author, using data from SUBDERE (2003), shows that the Los Lagos region positions (among 15 Chilean regions) in first place in "Science and Technology" and third in "enterprise quality". According to "Universidad de Chile" (2005) there are high levels of labor unionization and formal contracts.

However, considering the variables “people” and “economic results” the region positions in tenth and twelfth place, respectively, with low levels of education, health, laborers qualifications and high levels of rurality. On the other side, the study also shows that according to the “Ministerio del Trabajo” (2003) there are high levels of labor accidents, labor environments are cold and philological labor conditions are complicated and hard whereas wages are only 40% higher than the minimum legal salary in Chile (\$260.676 Chilean pesos).

Table 11

Poverty Indicators Variation, in Salmon and non-Salmon Districts of Los Lagos Region, 2000-2003 (%)

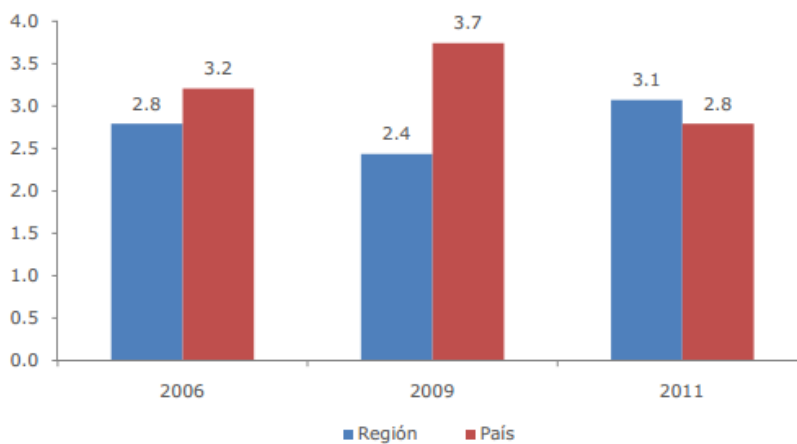
2000-2003 Variation (%)	Salmon Districts	Non-salmon Districts	Chile
Poverty	-11,0	-17,0	-6,0
Indigence	-40,0	-22,0	-10,0
Autonomous income	17,0	10,0	4,0

Source: Muñoz (2009)

In 2013, the Los Lagos region showed an employment net variation of 67,339 people employed. If we consider the positive variation between the January-March 2010 and August-October 2013 trimesters, only 32.4% of employment appertains to salaried workers and they were directly hired by firms. Thus the largest contribution of occupation came from self-employed workers (33%) and external salaried workers (32.4%). Together, they make up 65% of the total employment variation in the region (Páez “Minuta de Empleo Regional No.1: Análisis de la realidad regional según tipo de empleo generado”, Fundación Sol, 2013).

Figure 14

**Extreme poverty incidence on population
Los Lagos Region and Country, 2006-2011 (%)**

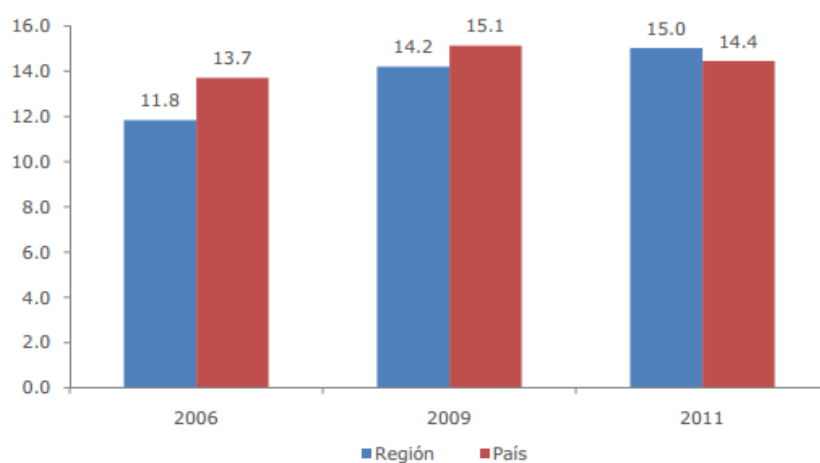


Source: CASEN, 2011.

Likewise, general poverty and the unemployment rates were also higher than the national averages for 2011 (CASEN, 2011).

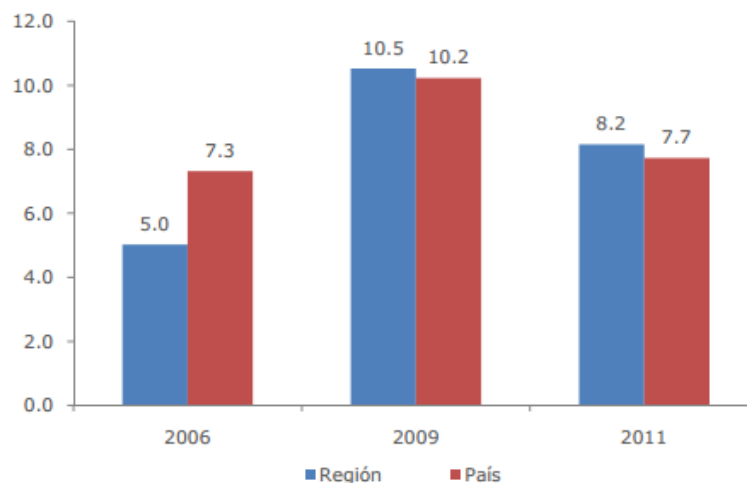
Figure 15

**Poverty incidence on population
Los Lagos Region and Country, 2006-2011 (%)**



Source: CASEN, 2011

**Unemployment rate
Los Lagos Region and Country, 2006-2011 (%)**



Source: CASEN, 2011

The lack of stable hired work offered in the region has its effect on poverty rates. For 2011, the incidence of extreme poverty was higher than the national average (CASEN, 2011).

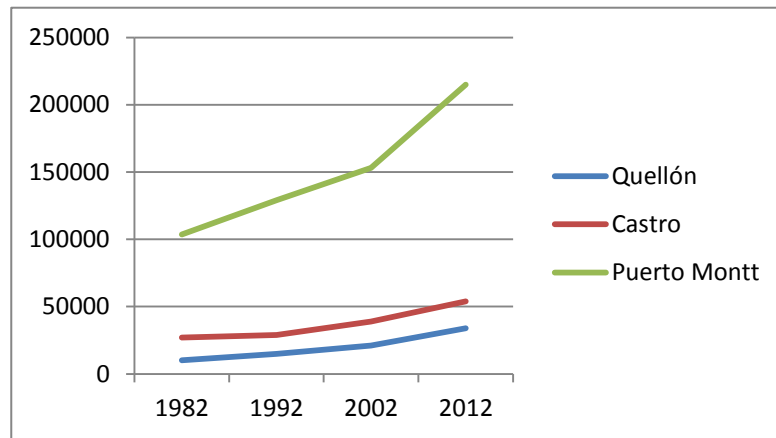
2. Socio Economic Effects and Regional Poverty

One of the most important regional impacts of the salmon industry in the Los Lagos region is related to the concentration of population in large cities of the region. A lot of headquarters of salmon firms and external service firms of the industry have been located in these cities attracting an important amount of people linked to new jobs offered by these firms.

In this context, this large population dynamic is associated to and could be explained as the result of the salmon industry emergence on the regional economic structures.

Figure 17

City Growth in Los Lagos Region



Source: Own Elaboration

As it is shown in this Figure 12, the population growth of the main urban centres where the Salmon Cluster is allocated has been significant. Undoubtedly the city that has shown the larger growth is Puerto Montt, which from 1982 to 2012 shows an expansion of 107% of its population today becoming a new regional development centre with a powerful spatial influence, acting as a centre of gravity of the Salmon Cluster in the Los Lagos region. Quellón in turn has increased for the same years in 233% and Castro in around 100%.

Considering the rapid development of these cities as the result of the emergence of the salmon industry in the region, it was necessary to define specific territorial planning in order to face these new requirements and new spatial regional dynamics.

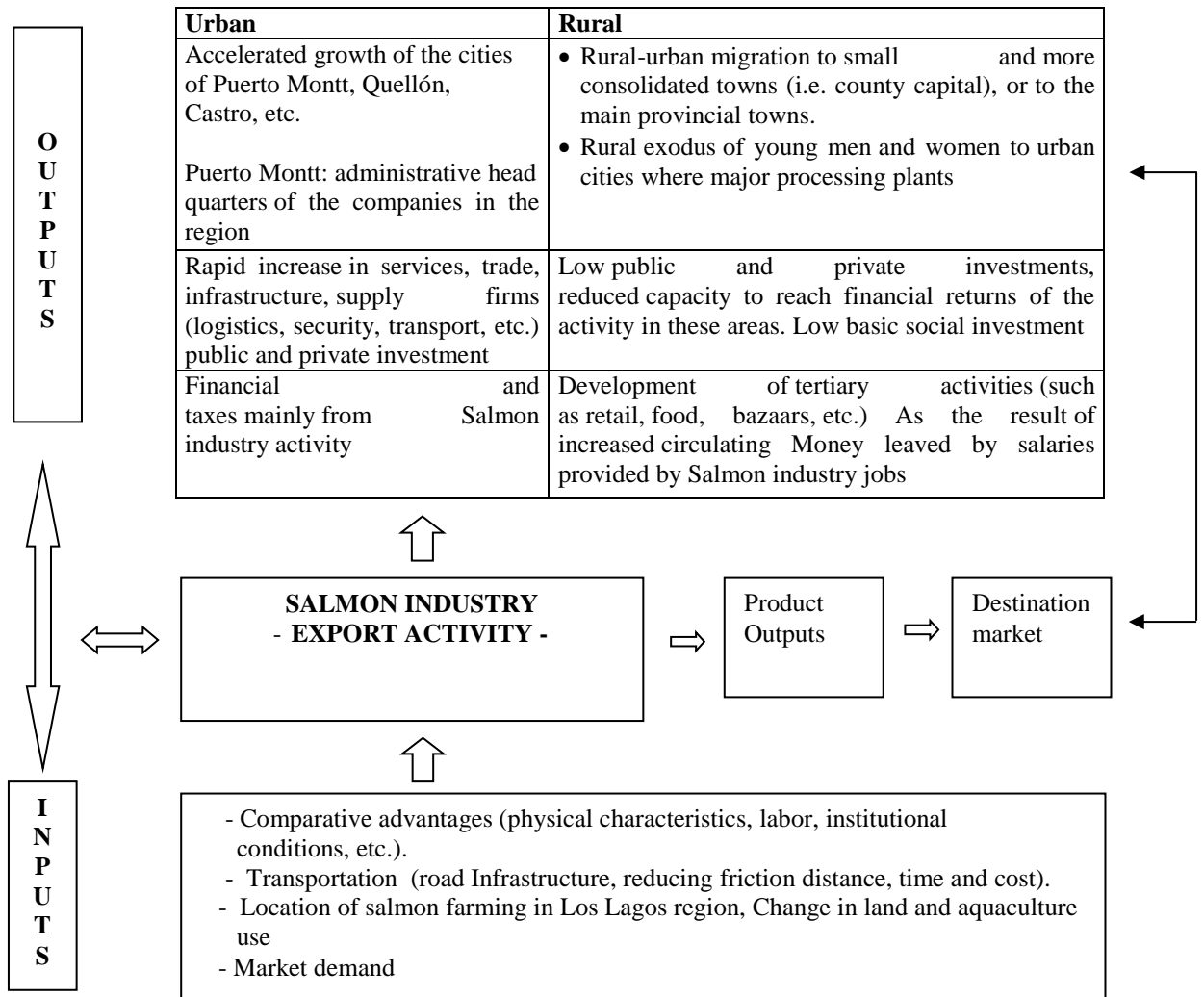
An expression of this preoccupation was the initiative generated by the Regional Government of Los Lagos region who carried out a Land and Coastal Use Plan for the region trying *“to give the basis and foundations that allow planning strategies for the coast of the region, based on the diagnosis of the coastline of the region through a digital georeferenced cadastre incorporating the main activities carried out in this region and then generating a coastal zoning proposal attempt to provide a balanced development of various activities, framed in the context of national policy to use the coast”* (1999),

3. Spatial impacts, Urban-Rural Interactions

The Los Lagos region is a systemic functional region that has the salmon industry as the main regional economic engine.

Figure 18

Inputs and outputs of Salmon Industry activity on Urban and Rural Areas



Source: Own elaboration from Apey, 1983

As is shown in Figure 12, salmon industry activity is located in a region with lower levels of industrialization affecting urban and rural areas in different ways creating a specific spatial dynamic featured by differentiable flows and outputs. The inputs to this system are the variables that have conditioned the existence of the salmon industry and the outputs are the results of these dynamics in different areas.

The impact of the salmon industry on rural and urban areas is easily distinguishable. However, within the urban context, the most interesting impact has been the consolidation and explosive growth of major urban centres through the exploitation of rural areas. This relationship strengthens the dependence of urban spaces on peripheral spaces, and especially, on economies based on the exploitation of natural resources.

An example of this is the high prevalence and growth that the city of Puerto Montt has shown in the regional reality, especially because the location of administrative offices of regional companies that have initiated a process of re-emergence, economic growth and employment, attracting people from the region and also other regions of Chile. On the other hand, in rural areas the benefits to the population mainly in economic terms have resulted in increased purchasing power and consumption associated with the new salaries. However, the increase of rural employment has not been translated at the institutional level (i.e. municipalities) being able to manage these revenues towards a planned community development.

In fact it has been argued that the salmon industry in some areas, such as Chiloe Island, carries out a global innovation model without the involvement of local actors. They have no influence in decisions that are affecting the territories in which they exert a political responsibility and a democratic role. Thus, there is a double hierarchy taking place: political and administrative responsibilities on the one hand, and public and private effort for economic development on the other. This parallel structure ultimately debilitates the local and democratic structures, in the name of pursuing national and regional economic growth (Fløysan et al, 2010).

CHAPTER VII: REGIONAL CONDITIONS TO PROMOTE INNOVATION

1. Evidence of Regional Innovation and the Salmon Industry

A main concern in this research is to determine the existing conditions for the presence of a Regional Innovation System based on the development of the salmon industry. As we have seen in the theoretical framework there are basic conditions that need to be studied in order to analyse an innovation system at regional level.

In this context, in order to know more about those conditions and the local disposition for the consolidation of a RIS in the Los Lagos region, a set of 25 interviews was conducted with representatives of all the regional private and public institutions that are currently involved in efforts to promote regional development, and others that could be part in efforts to create the conditions to the generation of a RIS.

Additionally, the perspective of the salmon industry analysed in the next chapter allows us to have a strong image of how the local productive and innovative scenario is currently composed and in what measure the innovation initiatives are linked to regional conditions.

Regarding the first step of the methodological process of content analysis and codification of the information provided by interviews, the following words and expressions were found closely and persistently associated to key concepts that are in the base of a RIS; Salmon industry; Networking & Associability, Knowledge, Innovation, and National–Regional scale.

I. Salmon Industry

- Resourceful.
- Highly productive.
- Pioneer (sometimes it is perceived as innovative, but mainly related to the moment of origin, when entrepreneurs imitated the Norwegian experience).
- Trans-national.
- Mostly large firms (small or medium firms are service suppliers but not salmon producing).
- High and negative impact on the region (low employment, low salaries, high pollution).
- Isolated in the region.
- Firms relate with institutions based on necessity of legal or technical approval.
- Over-extracting.
- Non innovative.
 - Blind.
- Non cooperative.
 - Arrogant.

II. Networking & Associability

- Fashionable concept in the last couple of years (it is a declared intention).
- A practice absent or infrequent.
- Unnecessary for the firms.
- Necessary for the development of the region (socially, environmentally and economically).
- Coordination between 6 larger firms (G6) is perceived as negative, because it leaves out all other institutions and firms.
- Without institutions to support it properly.
 - There is no one to mediate or link initiatives.
 - Former existing Cluster.

- Dangerous, it tends to decrease competitiveness.
- Firms relate with institutions based on necessity of legal or technical approval.

III. Knowledge

- Abundant.
- Available.
- Enclosed.
- Generated abroad.
- Local knowledge is generated without the support of firms.
- Firms generate their own knowledge (taking it from abroad, or hiring consultants for specific problem solving).
- Informally shared.
- No long term planning.

IV. Innovation

- Fashionable Concept in the last couple of years.
- A practice absent or infrequent.
- Unnecessary for the firms.
- Undesirable on its own (it needs to be focused on social, health and environmental issues, rather than just in business).
- No orientation or regulation of where to aim innovation (every firm decides on the basis of particular needs and events).
- Response to occurring problems, rather than long term planning.
- Related to technologies rather than to profound or complex procedures.
- Most frequent in small or medium size firms (quicker to change).

V. National - Regional

- National funds are not largely used by the firms
- Regional efforts to distribute funds properly.
- Lack of regional autonomy for deliberation and resources.

After identifying this set of general codes, the re-coding of the interviews was conducted, and the set of codes became more specific for each group of interviews, governance group, support group, research group and municipalities group. The effort was to retrieve a detailed view of how each sector that characterize the conditions of the regional salmon industry, the local institutions and their resources, for the development of a RIS.

Each set of institutions established their own associations, generated their own expressions and offered a dissenting relevance to some of these concepts. Accordingly, each gave a particular “Atlas.ti network view” or conceptual map:

Figure 19

Governance group of Institutions

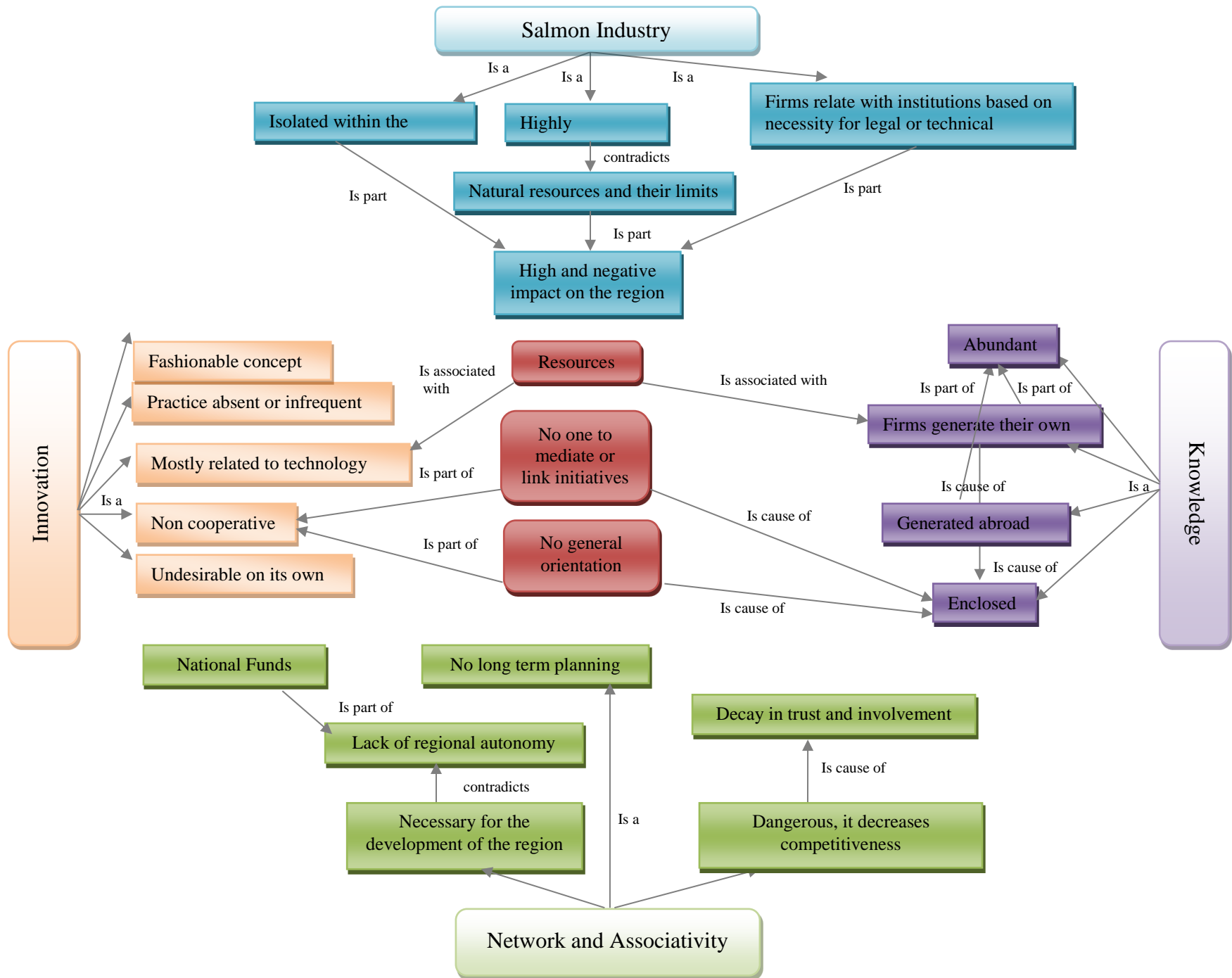


Figure 20

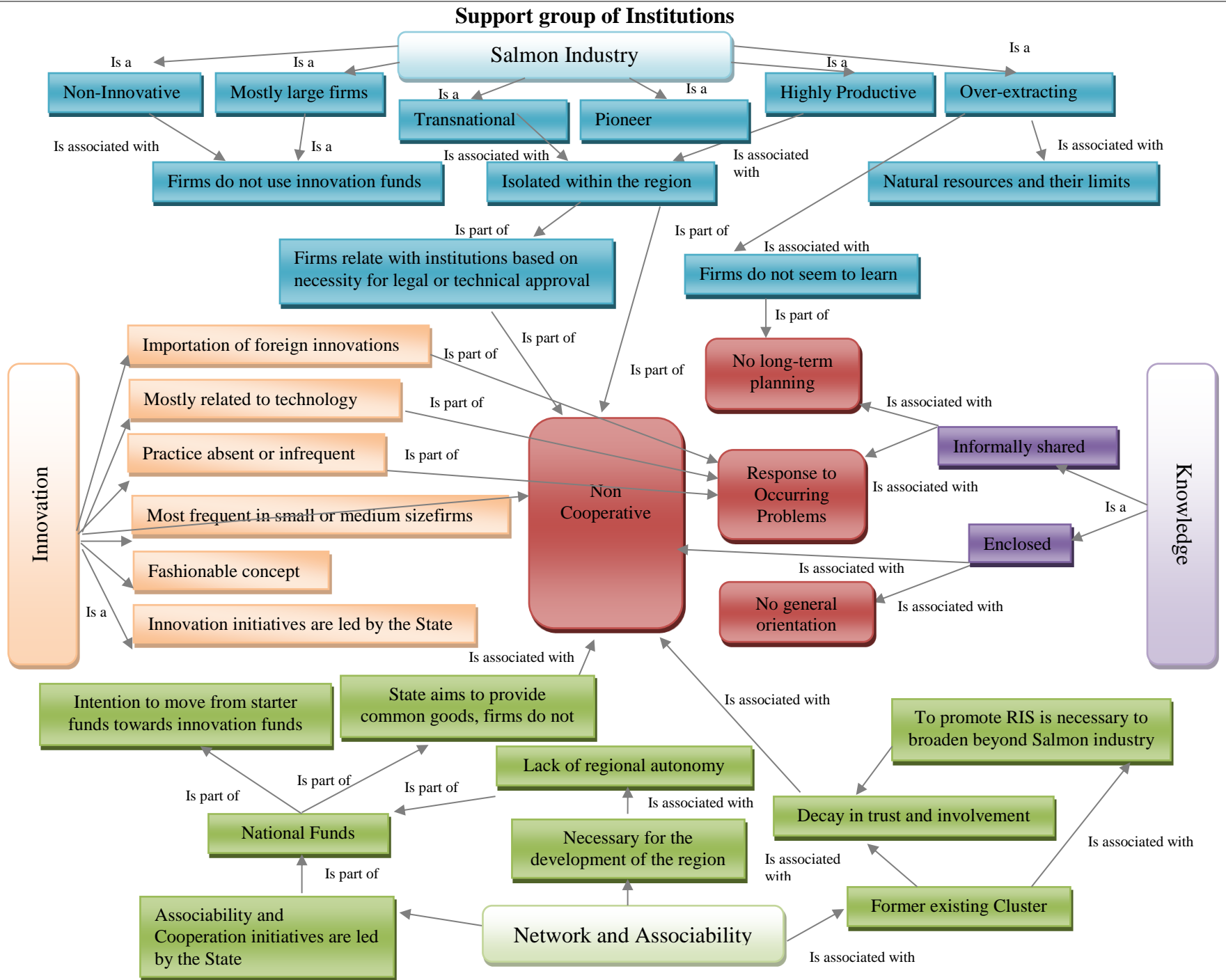


Figure 21

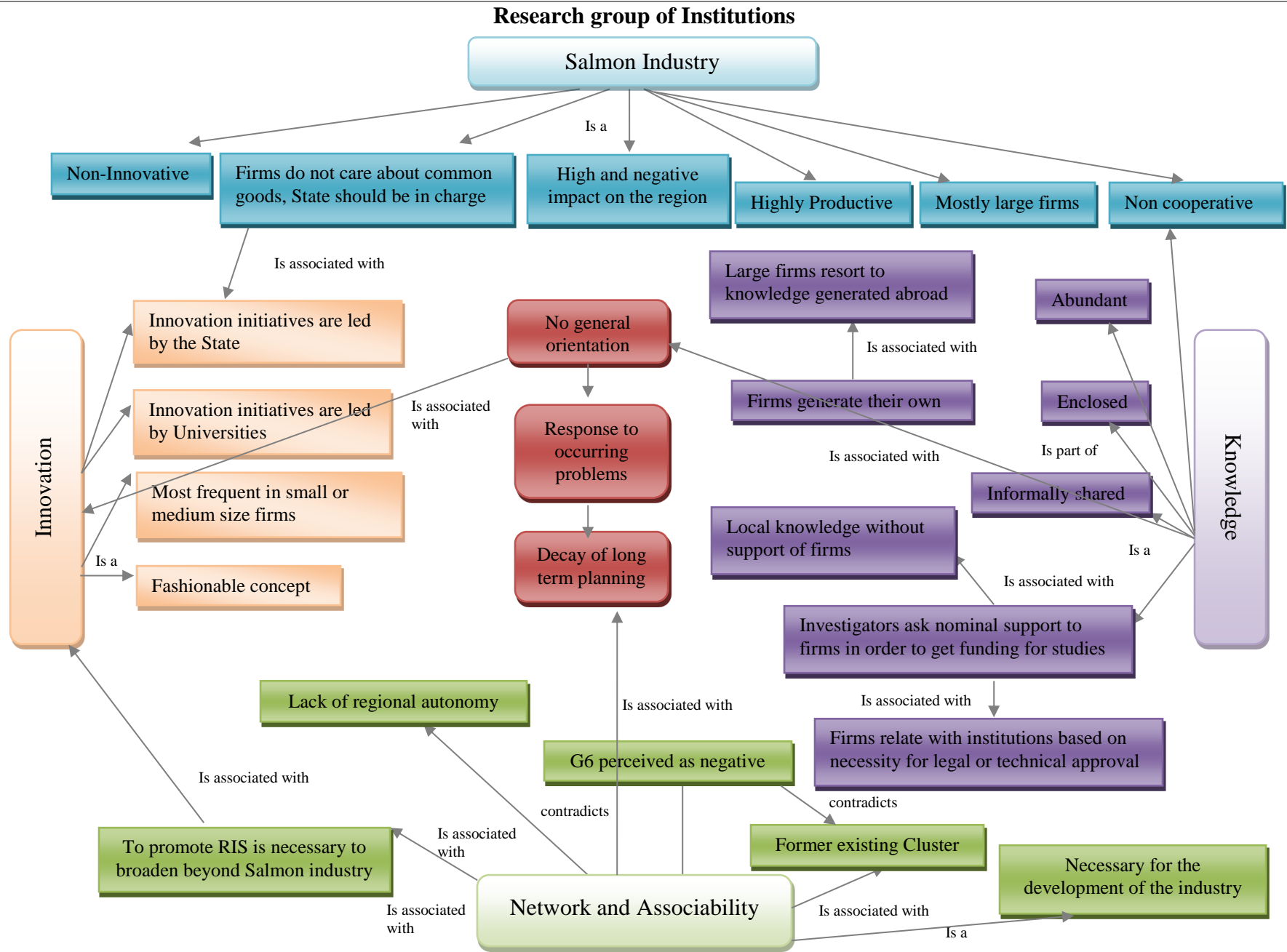
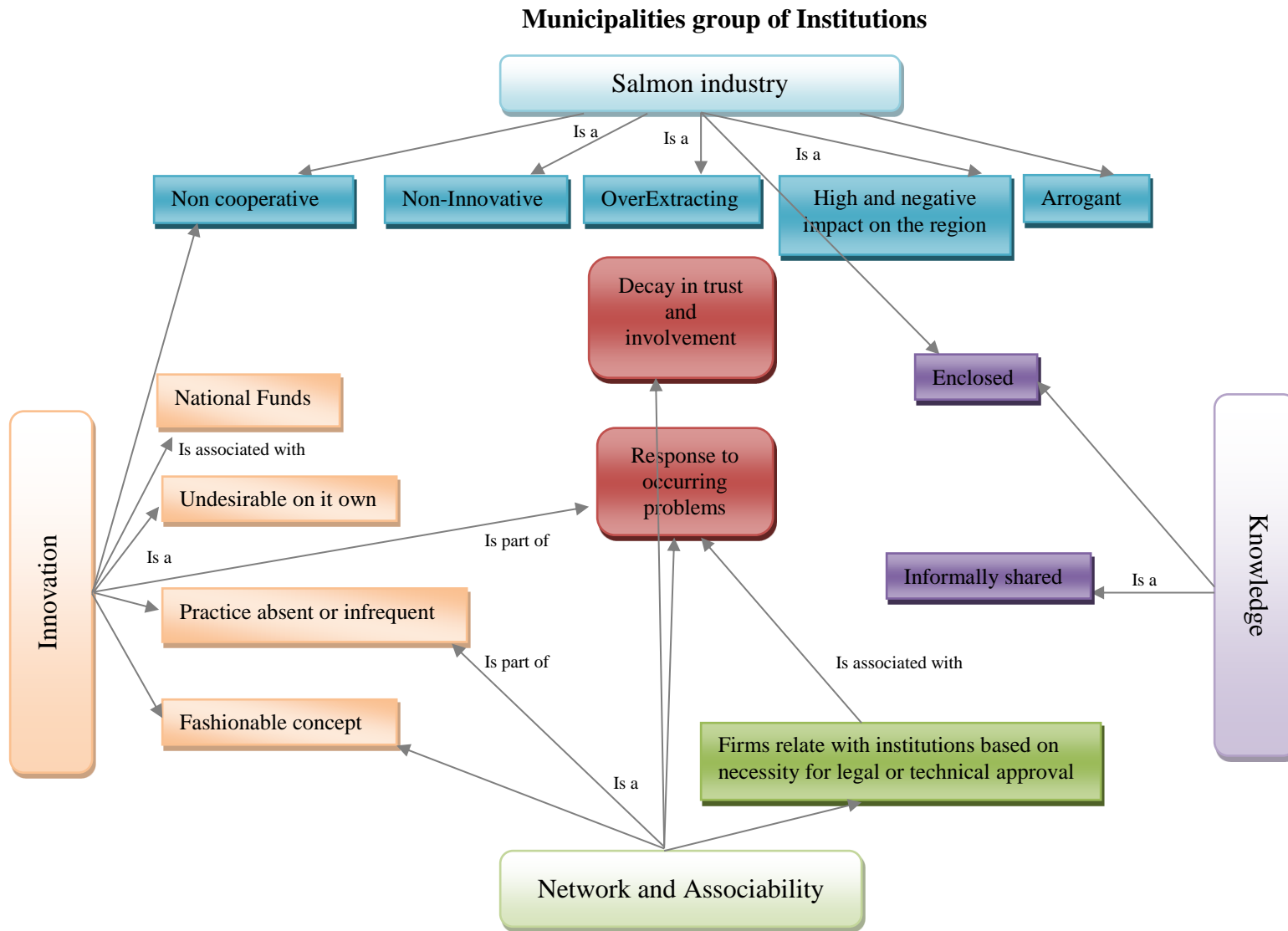


Figure 22



2. Synthetic Analysis of Results

❖ Group of Governance Institutions (Figure 19)

According to Figure 16, public and private institutions of governance see the salmon industry as a fairly isolated area and only linked to regional institutions to resolve specific needs that have to do with legal and technical aspects.

Considering aspects related to innovation in the salmon industry, innovation is seen as a rare practice, mainly based on individual and non-cooperative processes. One of the reasons is because there is no a mediator to coordinate regional innovation initiatives among regional agents. As part of this process, although the knowledge generated by highly specialized industry is abundant, it is considered that it is mainly generated outside of Chile and is being held in the companies that create it.

Finally, considering aspects of associativity and networks in the region, it is considered that although they are necessary for the development of the region these are scarce and are mainly the result of a lack of regional autonomy to make decisions. Additionally, it adds a low capacity of companies to rely on other regional actors involved in these networks.

❖ Group of Support Institutions (Figure 20)

According to Figure 17, supporting institutions consider that the salmon industry is highly productive, but is currently reaching a point of over-exploitation of their natural resources in the region that are the base of the productive factors of the industry. The salmon industry is mainly linked with large transnational companies that do not use public funds to generate innovation processes and as an industry is quite isolated in the region and is characterized by a significant lack of cooperation both among private players in the industry as with stakeholders from public and private institutions in the region.

Considering innovation initiatives that are generated by the sector, in the view of supporting institutions they are rare practices, which are mainly imported from abroad and when are carried out are developed by small and medium firms that must continually

deliver services to meet specific needs. However, it is interesting to note that it is considered that, in many of these initiatives are led by the State. Moreover, the knowledge generated by the industry remains retained in the firms and is only informally shared among industry players.

Finally, it is considered that networks and associativity are necessary for the development of the region and for the generation of a RIS that includes the salmon cluster. Again, it is noted that the lack of autonomy of the region to make decisions is quite negative for the development of the industry and the region. However, it is stressed that associativity is promoted by the state through national funds and that the intention is to increase the funding for innovation and continually provide conditions and initiatives to promote the development of the industry.

❖ **Group of Research Institutions (Figure 21)**

The institutions involved in research initiatives in the region consider that the salmon industry is very low innovative and non-cooperative. Firms, especially large companies are not interested in generating or use public goods or externalities provided by the region.

Innovation is seen as a fashionable concept which is led by the Estate. Different innovation initiatives are mainly developed by universities in the region and small and medium firms. Moreover, the knowledge generated by the salmon industry is abundant but is generated for individual initiatives and therefore it remains retained in the firms and is only partially shared through informal instances.

Considering finally the networks and associativity of the salmon industry, research institutions believe in the importance of regional diversification and in that context the promotion of RIS should go beyond the development of the salmon industry. Moreover, the consolidation of the G6 (group of 6 major salmon producing companies in the world) is negative, because it concentrates in a few private agents the development of the industry hampering the industry association.

❖ **Group of Municipalities (Figure 22)**

According to the group of municipalities, the salmon industry is again considered very innovative, arrogant and uncooperative. It is mentioned the preoccupation for the low sustainability of the industry linked to the exploitation of natural resources. Innovation is considered an absent or infrequent practice associated mainly to national funds provided by the state. In this context, the knowledge on which innovation initiatives is being held in firms and it is only shared on informal instances. Finally associative initiatives are only generated in order to solve specific technical or legal problems.

However, despite the last first general approach of figures 19, 20, 21 and 22, the content of each figure will be further explored, allowing us to offer a simplified view of this analysis by sections of each figure. Hence, we have incorporated to the exposition of the results a series of diagrams as an effort to summarize and clarify some aspects of the Atlas.ti based analysis.

3. Disaggregated Results and Major Outlines

From a RIS perspective, coordination between different actors in a specific region is essential. This coordination often relies on regional and national planning, but it also depends on the willingness of the people and institutions at the local scale to participate in a regional cooperation dynamic.

As previously shown in the theoretical framework, the importance of culture and trust in the economic activity performance, coordination and development has been recognized. Therefore, from a cluster perspective it is of the most importance to focus policies on the relationships between competition and collaboration (Cooke, 2004). There is a strong emphasis in the fact that trust reduces transaction costs, it facilitates generation and transfer of skills, and promotes incremental and diffusion of innovations among firms (Asheim, et al, 2007).

On the other hand, innovation in terms of a RIS should be considered and developed as a complex system, and not as isolated initiatives that result in particular new products or new procedures.

In these three broad dimensions (national planning, level of trust, and innovation as a system), the interviews conducted in Los Lagos Region showed an important amount of challenges for the development of a RIS that we will now proceed to detail considering key concepts that conform each relevant topic that were collected and analysed from the discourse of governance, support, research and municipalities institutions; salmon industry, territory and salmon industry, networking and association, innovation, knowledge, and national-regional scale.

3.1. Relation with Salmon Industry

Key Code: *“Firms relate with institutions based on necessity of legal or technical approval.”*

For the most part, people interviewed from the different institutions (Governance, Support, Research and Municipalities) declared that the relation that they personally, their department and the institution had with the firms and with the salmon industry, was in general none or indirect.

Governance institutions claimed to have a narrow lane by which they communicate with the firms and the salmon industry as a whole, and that it is basically in one respect only: the delivery of control regulation information towards the industry and the receiving of approval solicitations from the firms. In some cases it was declared that even when the firms do not meet the minimum standards for justifying their practices, it is the Governance institution that provides the backup information or arguments for the approval of their need:

“The only link we are interested in, and it is very indirect, is the Donation with Social ends Law. We hope business is going well so that firms make donations, so that the

social development fund grows and we can develop more private funded projects.”
(SEREMI Desarrollo social)

“(…) they mainly ask for us when are entering products to the country, there is no more contact with them. Also when they need authorizations or ask for a legal procedure. Generally speaking our relation is based in consultations about legislation.” (SEREMI Salud)

There is no active participation of the firms in the planning of control programs and regulations, nor are there proposals, but in some cases only a negotiation table, where the governance institution tries to come to an agreement on some regulations from the firms that are consistently pulling to reduce regulations on production, extraction and waste management.

According to the statements, research and educational institutions have two ways of relating to the salmon industry: by generation of knowledge and by generation of human capital, and in both cases the industry does not participate directly or actively.

In turn the research institutions themselves try to establish some relation with the development of the industry by focusing on the production of useful knowledge or appropriate human capital formation that they can identify on their own. We will see in further detail these knowledge issues later on.

From the support institutions it was declared that the salmon industry firms do not participate frequently in their foment programs. Mostly because it is a resourceful industry that does not see the use of public funding, and also because the resources delivered from these institutions aim largely to the small and medium sized local firms of different emerging industry, such as the service providers for the salmon industry and others.

“We have 5 or 6 big firms from the salmon industry that are doing something with CORFO, that’s not a lot, is a 15% or 20% of the total of big firms that could be doing something. Now, considering the small and medium size firms (PYMES) related with the industry (services and alike), CORFO is much more present, but they are not salmon producing firms.” (CORFO)

The municipalities' view is not only critical towards the lack of involvement of the firms with the region and its institutions, but also in regards to the negative impact that the industry has socially, economically and environmentally on the region.

They stated that the salmon industry firms only communicate with municipalities when they need political support from the local council or when they need low skill workers. In addition they considered it to have a huge negative impact on the region, in different aspects.

Key Code: *“The salmon industry has a high negative impact in the region.”*

From the regional bureaus of the ministries of health, social development and environment, and all of the municipalities interviewed, there is a recurring negative assessment of the role of the salmon industry firms on epidemic prevention, local employment, and environmental care.

The salmon industry was often associated with having no concern for the common wellbeing, being isolated from the region and having no interest in coordinating or collaborating with the local community including other industries and competing firms.

Generally speaking, the salmon industry was described as an encapsulated industry within the region, both in terms in the production process and also in the distribution of benefits drawn from the extraction in the region.

In spite of offering jobs and generating the increase of GDP, many of the salmon industry's impacts are harmful for the region's development (low quality of jobs, managing of residuals, over-exploitation of natural resources, etc.), as was detailed in previous chapters, and this impact is strongly allocated in the local institutions perception of the industry.

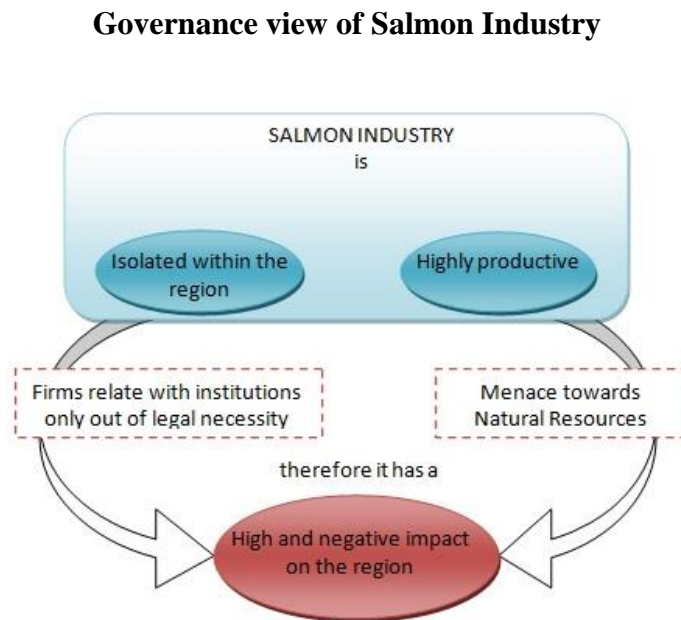
It is also perceived as a highly unequal industry, where capital is concentrated on a few big firms that do not cooperate with the smaller firms. The G6 (a group of the 6 larger salmon producing firms) was often referred as an example of the lack of integration of the industry in the region, rather than of a cooperative one.

“There are some business partners that have even come to say that it would be good if there were only 6 firms left, and they have started to form this G6, which is the association of the most important firms. From my point of view this is not good, because Chile can’t have a Congress, a Senate, a SERNAPESCA, a Fishing Sub-secretary, all for 6 firms, it is outrageous to have a full administrative apparatus making better laws and services for only 6 firms; it cannot be! a whole country at disposition of 6 firms (...) when you have things like these happening, it shows that there is no associability; when a group of the largest decides all they want to decide, it means that the rest is disposable, and this is being promoted here in Chile.” (Universidad de Los Lagos)

This partnership among the 6 larger firms seems to be another obstacle for the creation of a complex and integrated system of firms and institutions suitable for a RIS in the region.

Governance’s view of the salmon industry could be represented as follows:

Figure 23



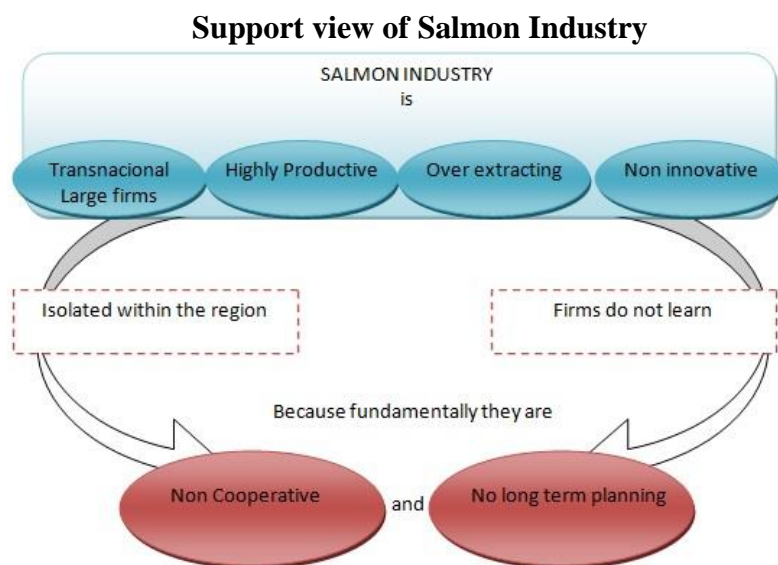
Source: Own Elaboration

Across the interviews, the salmon industry was strongly associated with the words “arrogant”, “isolated” “high and negative impact”, all of these accounting for an image that

can only be an obstacle for the trust and collaboration needed for a RIS around the salmon industry.

Support's view of salmon industry could be summarized as shown in the following figure:

Figure 24



On the other hand a conflicting view was found in some institutions. The Regional Bureau of the Ministry of Economy (SEREMI Economía), the National Fishing Service (SERNAPESCA), and the Sub-secretary of Fishing (Subsecretaría de Pesca), had a slightly more positive image of the salmon industry.

Key Code: *“Salmon industry is highly productive”*

In some institutions emphasis was placed on the economic achievements of the industry, and on its capacity for growth, both seen as positive aspects and also as potential for improvement on conflicting areas such as innovation. Some of these aspects were shared

across most of the interviews, but were not taken as promising or as relevant as they were here.

In this set of interviews there were recurring references to the prowess that the firms have accomplished in becoming the second largest salmon producing industry in the world. There is a strong appreciation of its role as “food producing”, which is regarded as a fundamental piece of the world wide economy.

“We are and should be even more a food producing potency. We know the world population is growing; we are now 7.000 million and projections say that by the half of this century we will be around 9.000 millions. The future is very auspicious, and not just for salmon industry, but for all food related industries.” (SEREMI Economía)

In this sense the fact that in the region it functions as a trans-national industry is also regarded as a positive feature. From this perspective, the salmon industry is also innovative and even has some relations with other actors in the region. It is declared that there is still a long way to go on some issues, but that this is an industry that we should be proud of.

Aside from the particularities of some of these declarations, it is commonly agreed that salmon industry has developed enormously since its origins 30 years ago, and that in terms of growth, it is now a mature industry.

The dissenting aspects of this set of interviews with respect to the majority will appear in the discussion of different subjects, such as innovation and cooperation.

3.2. Territory and Salmon Industry

References to “geography” and “territory” as a factor for the development of regional networking, were also scarcely found and in most cases absent. The few references to these concepts were related to the negative impact that the salmon industry has had on the local ecosystem and on the local community, particularly on the quality of the employment offered.

Key Code: “*Natural resources and their limits*”

In other cases “geography” was associated as a fortuitous beneficial factor that has allowed the growth of the salmon industry, thus it is mainly associated with natural resources and also with the load capacity that is perceived as constantly menaced by the extracting industry. But it is not seen as a factor for the development of an integrated network in the region, or at least, the institutions estimated that territory and proximity are not seen as resources in that way by the industry, but just as a rich space for extraction.

In this case the fact previously described when local concentrations of activities are frequent seems to be taking place, but this does not necessarily mean the conformation of a competitive cluster, nor the capacity to generate a competitive industry based on scale or scope economies. That depends on the attractiveness of local conditions and the capacity to competitively and sustainably exploit a natural resource -which in this case does not seem to occur.

We have considered also that common problems such as path dependence to the generation of entrepreneurs in this low tech industry may become also an important trigger to the generation of new ideas (Hirsch-Kreinsen and Schwinge, 2011). But in order for this to happen, there has to be some collaboration between firms and institutions, otherwise all response, innovation and learning processes will be as enclosed as everything else in the industry is.

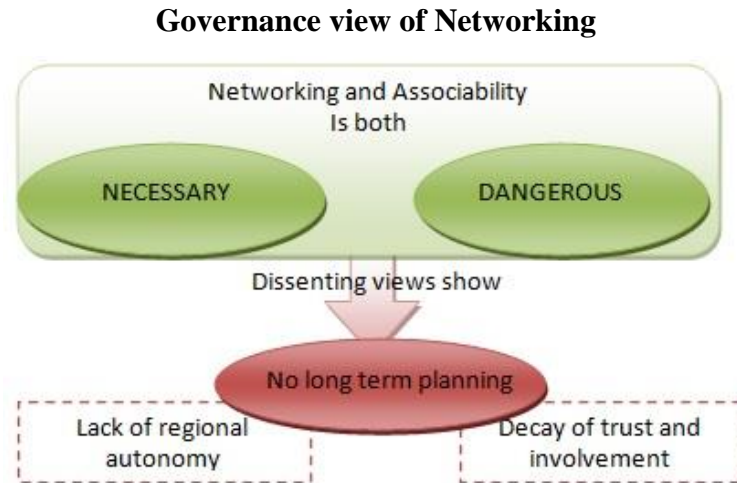
3.3. Networking and Association

As it was detailed in previous chapters, the salmon industry is not a complex system in terms of integration and networking. It was stated also in the interviews that from the institution’s perspective it is regarded as having isolated itself within the region.

However we are seeking information not only on the current display of networking, but for any disposition that could potentially become or contribute to one, in order to develop a RIS. In this sense we find both opportunities and challenges within the discourses attained from the institutions interviewed.

Governance view of Networking could be synthesized as follows:

Figure 25



Source: Own Elaboration

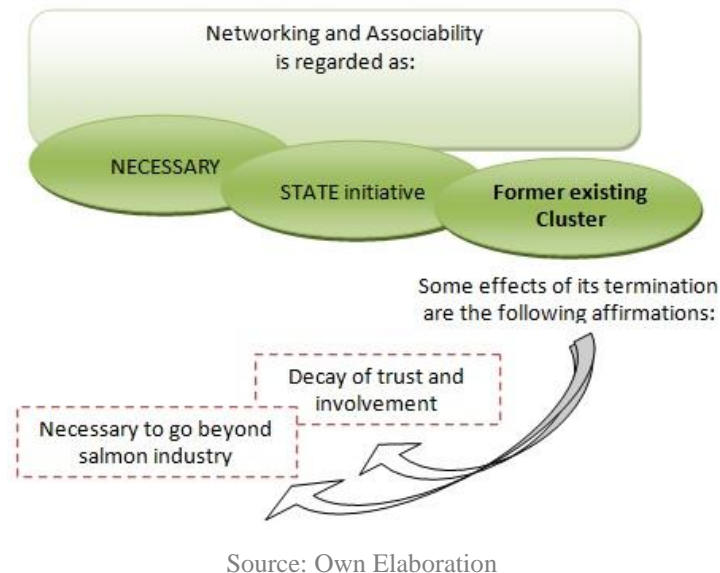
Key Codes: *“Decay of trust and involvement”*, *“Lost of...”*, *“Lack of...”*

Firstly it can be noted that there is a strong association between networking and the past. When asked about collaboration between firms, or any type of coordination between firms and institutions of any kind, more than often past initiatives and former institutions are brought to the table. There is also a recurring reference to the former closeness that different institutions had with local development, especially economically, that now is perceived as being lost.

Support view of Networking:

Figure 26

Support view of Networking



As examples of networking with the industry, 3 events were brought to the table:

a) Governmental intervention previous to the origin of the industry:

It was noted that in the early 1970's the central government promoted the opening of university programs to explore the salmon industry in the region. That was interrupted in later governments. This is regarded as a visionary effort to bring regional and national development amid a strong institutional surrounding, a manner of dealing with the local industry that is now considered to be lost.

b) Clean Production Plan:

This was a governmental program led by CORFO (an important governmental support corporation towards production) that managed to establish a close relation with firms around waste manage and clean production. This program is referred as one of the few well accomplished instances of close collaboration in which many firms participated, but it is also considered as an effort that lost its continuity.

c) Former existing salmon cluster:

It was a governmental instance that is remembered as unique in the sense that it involved all of the firms and critical actors in the salmon industry. In some cases, even though it no longer exists, people name it as one of the current spaces for general coordination of institutions with the firms.

A common expression across the interviews is that “the national policy changed”, but there is no clarity towards what, just the shared sense of a loss. This actually means that public policies related to industrial development are not considered as long term policies and they have changed depending on the government administration. During the government administrations of Presidents Eduardo Frei Ruiz-Tagle, Ricardo Lagos and the first administration of Michelle Bachelet (1994 - 2010), an industrial policy was initiated that focused on the promotion of the Regional Clusters based on well-developed and potential economic sectors in a few regions of Chile, such as the fruit industry, mining and the salmon industry. However, this policy changed during the last government administration of President Sebastian Piñera (2010 -2014) who emphasized the roll of market to promote specific sectors of the economy.

Considering that RIS basically consists of the interaction of sub-systems linked to broader systems (Cooke. 2004. p. 3), the lack of a sub-system based on a salmon cluster could leave a barren scenario for the development of a RIS.

However, a cluster is not an exclusive pre-requisite for the formation of a RIS. As was presented in the theoretical framework, it is possible that clusters or more than one cluster and RIS can coexist in the same territory; however, it is not necessary that a cluster be a part of a RIS (Asheim and Coenen, 2004). The first pre-requirement for the emergence of a RIS are not regional clusters, but regional innovative networks, cooperation and organization activities between firms (Andersson and Karlsson, 2004). Furthermore, regional clusters are seen more as spontaneous phenomena while RIS have a more planned and systematic character.

In this sense, beyond the absence of a cluster policy in recent years, what could be more critical for the development of a RIS around the salmon industry in the south region of

Chile might be the real dispositions of regional actors towards cooperation and organization among firms and institutions.

Key Code: “No general orientation”, “Individualistic industry”

There are dissenting discourses regarding the importance of coordination and association in the development of the region as a whole. These conflicting views may be at the root of the sense of disorientation and loss.

In most of the interviews it was stated that firms don't display a strong intention to collaborate or to generate networks within the region, nor between the firms themselves. Accordingly, the existing coordination is assessed as insufficient and inoperative for the most part.

In the support institutions view, the firms refuse to associate or collaborate, and only after a crisis were they required to relate more with governmental institutions, respecting the “neighbourhoods” program which, according to this perspective, was promoted by governmental initiative.

From the research institutions it is stated that salmon firms do not even work with each other; they do not plan interventions or studies together in order to prevent risks. Each one responds to the particular and current need that they themselves identify. In agreement with this, support institutions see the salmon as an individualistic industry, oblivious of the importance of guarding the industry as a whole. They also declared that for the most part associative initiatives are led by governmental institutions and programs rather than by the industry.

All of these features associated with the salmon industry are regarded as highly problematic for the development of the region and the industry itself; more networking and associate collaboration is viewed as necessary to increase the competitiveness of the industry (diminishing the gap between bigger and smaller firms), and to increase innovation.

On the other hand, governmental institutions that we have identified as a separated set of interviews based on its divergent content (regional bureau of the Ministry of Economy SEREMI Economía, National Fishing Service SERNAPESCA, and Sub-secretary of Fishing Subsecretaría de Pesca) continue to depict a contrasting view.

From their perspective, there is enough dialog and collaboration between the different actors in the region and there has been a significant improvement in respect to previous states of the industry. Accordingly this evaluation of networking in the industry relates to their manifested notion that networking and associate collaboration is a “complicated matter”, not necessarily desirable, because it has the effect of diminishing competitiveness and productivity. This is the view exerted by the Ministry of Economy and thus it may be at the basis of the conflicting discourses and efforts for networking in the region.

In the theoretical framework we considered that networking can be also viewed as an obstacle for innovation, in particular when strong path dependencies are at hand; strict rules, institutional memory or collaborative expressions could convert the region into an inflexible system, and work as an obstacle to the creativity and innovation processes and not permit commercialization of new knowledge to solve problems (Cooke, *et al*, 2007).

In terms of the cluster policy, it can even be argued that with the evolution of the salmon cluster, governance structures have tended to generate quasi-hierarchical market relationships (Maggi, 2002), and thus its dissolution would be a necessary measure for the future development of a RIS in the region.

We thus face a conflict of perspectives where the role of networking is a critical issue. In one, networking and collaboration are pre-requisites for an integrated innovation system and, in the other, they are major obstacles for the necessary flexibility of firms.

Nonetheless, the existence of the regional salmon cluster may be an opportunity to generate socioeconomic development in terms of the improvements in the area of products, production processes, infrastructure and human resources. And in this sense the absence of a clear alternative indicates a deliberate and conscious decision to abandon such efforts.

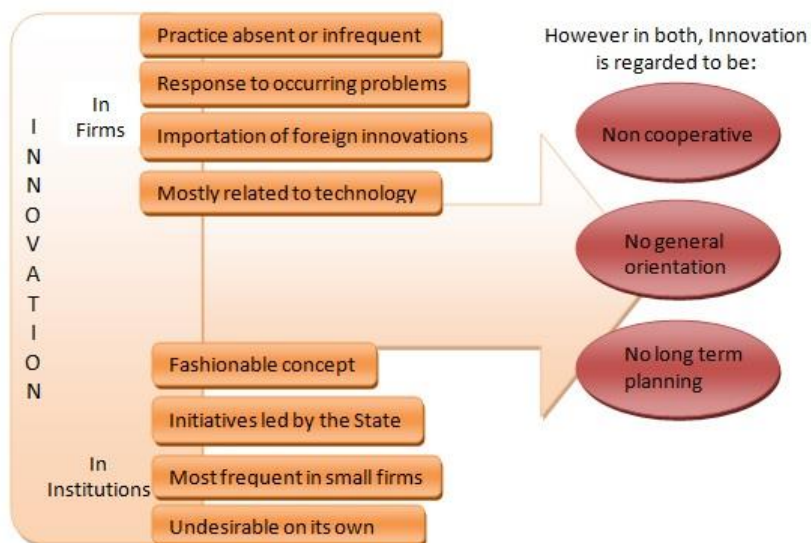
3.4. Innovation

In the context of a RIS development process, innovation takes on a level of complexity that might be at a loss in the most traditional notions of innovation. Closely related to knowledge, flexibility, long term planning and creativity, innovation as a system demands certain paradigmatic changes for low tech-industries. More than often these changes do not rely on the acquisition of new technology (or in becoming a high-tech industry), but in the disposition to become more dynamic and integrated with different sources of creativity and resources.

The most frequent associations around innovation can be diagrammed as follows:

Figure 27

Frequent Associations around Innovation



Source: Own elaboration

Key Code: “*Practice absent or infrequent*”, “*Related to technology*”, “*Salmon industry is non innovative*”

Across most of the interviews the description of innovation and the reference to innovations in particular was rather scant.

Innovation as a concept is mostly associated to technology and therefore capital. From that line of thought, as the salmon industry is perceived as a highly productive industry, some sectors declared that it has a lot of innovative capacity and initiative.

Innovation is mainly associated with access to technology and in that regard both the Regional bureau of the Ministry of Economy (SEREMI Economía) and the National Fishing Service (SERNAPESCA) have a positive vision of the salmon industry.

However, the most extended view across all institutions considered is that the salmon industry is far from innovative and lacks the real intention to ever become one.

Support institutions are blunt in declaring that the Chilean salmon industry is not innovative. It does not participate in the governmental programs, and it has neither long term nor a profound vision of innovation. It just innovates by force of the market or natural crisis demands.

From universities innovation is seen as a foreign and far concept for the firms, mainly because it is thought that their prime concern is to generate incomes. In this regard the relation to knowledge is also submitted to this immediate need and thus relegated in importance. It is stated that firms are comfortable with being an extracting industry as long as it reports economic revenues in the short term.

Key Code: “*Smaller and medium size firms*”

However it is recognized that smaller firms which are not salmon producing but mostly provide services to the industry, tend to be more innovative because they are more flexible and also are more compelled to be.

Research institutions note that within firms, the smaller and medium sizes are regarded as the most interested on innovation, as well as the ones that have more relation with universities, backing up research and soliciting information.

Key Code: “*Undesirable on its own*”, “*Fashionable concept*” and “*No general orientation*”

In terms of the place of innovation within the interviewed institutions, we can observe that it is also a foreign and limited notion. As it is associated mostly with technology, Governance institutions and municipalities assign innovation to firms and the industry as their responsibility and concern, having almost no relevance for their own fields of work (such as community, health, employment, and even environment).

In fact, when asked for their own institution's awareness of innovation in the region, most of them stated that they do not care for innovation in itself.

Some governance institutions showed concern about the innovations of the industry in terms of checking if it has an impact on the environment, but no further involvement was declared.

From research and support institutions it was recognized that innovation in the region is very rudimentary and that it is mainly a fashionable concept. It is known to be a promoted concept from different institutions, even through public funding, but it has not had a previously determined a regional and coordinate course of action, nor is it overseen in its execution, and ultimately every firm and institution defines what constitutes innovation or not.

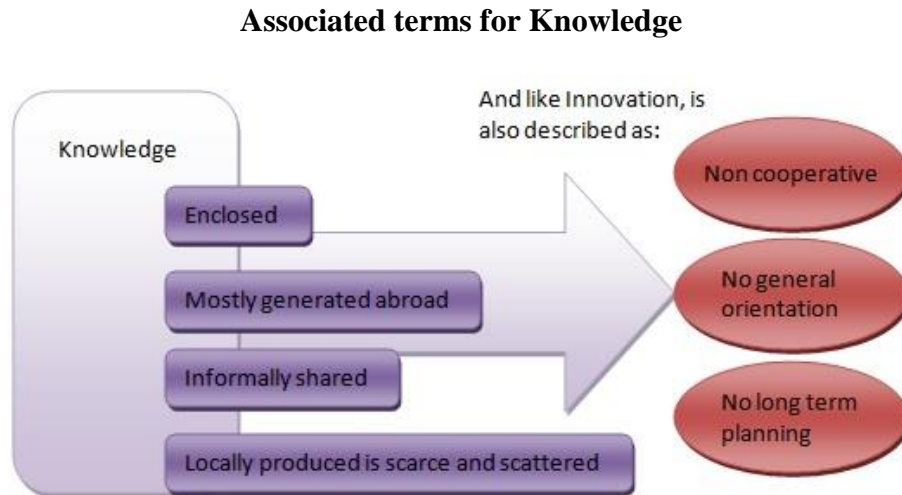
3.5. Knowledge

As it was developed earlier, knowledge is a crucial factor in the formation of a RIS. Whether it is derived from practice or theoretical exploration, the exercise of reflexivity applied to local endeavours is a permanent injection of movement on the dynamics of a RIS.

The openness of firms and institutions -involved in the development of a region- to receive and share knowledge is commonly regarded as a core condition for innovation dynamics.

Most associated terms for Knowledge:

Figure 28



Source: Own Elaboration

Key Codes: “Enclosed” and “Generated abroad”

In the interviews conducted in the Los Lagos region, knowledge was not frequently associated with innovation nor with the development of the industry. In coherence with the relegated place that innovation showed, knowledge was perceived mostly as enclosed, whether in firms or in universities, and primarily attained from abroad.

From governance and support institutions it was stated that bigger firms generate their own knowledge or get it from abroad, and that it always remains enclosed; they do not share it with their peers from the local industry. This relates to what was mentioned earlier in the theoretical framework about the effect of the multinational character of the locally based firms of the industry. It’s been noted that they may reduce institutional and collaborative R&D networks because they tend to generate internal R&D (Enright and Ffowcs-Williams, 2000, and UN, 2006).

It was retrieved that the few instances of spreading knowledge were the bi-annual fairs, and mostly informal and personal relationships between people from different firms. There is however an interesting case where former firms employees are now working in

municipal departments, and were mainly hired for their experience in the salmon industry. This may be a linkage to further explore.

“We have been here for 4 years now, and the mayor wanted us because we had experience within the industry, and the person in charge of the Municipal office of Job Information (OMIL) is himself a salmon producer, hence we have a better understanding of what the salmon industry is asking of the Municipality -which is a rather new issue.”
(Municipalidad de Ancud)

It is admitted as well that the firms do not absorb knowledge generated by the institutions. Only in the previously detailed event in which the firms lack of the necessary backup evidence to support certain measures taken, some firms rely on the institution's work.

Now, considering that the salmon industry is a low-tech and therefore a synthetic knowledge based industry, the sharing of locally produced knowledge is of the utmost significance. As was previously exposed, in the case of engineering based knowledge industries, spin-offs, R&D initiatives and university-industry, collaboration is reduced and innovations are mainly the result of experimentation (learning by doing) and the use of specific know-how (Asheim and Coenen, 2004).

This scenario was confirmed also by the perspective recovered from the research institutions interviewed. They noted that firms do not go to them to plan any research, but only to ask for specific accomplishments of predefined research objectives. In this sense they declared to be treated as a private agency that merely sells legally respected approval, which is from time to time needed by the firms. This kind of relationship was also, as it's been described before, common to depict the relation that the industry in general has with all institutions in the region.

Key Codes: “No general orientation” and “Smaller and medium size firms”

On the other hand, universities agree that there is not enough access to funding (public and private) for the development of more intensive research in the region, and that the efforts from within the institution are constant. Universities claimed that most of the time knowledge remains enclosed also because there is no follow up on the researches, and this

indicates for them that the main concern for different reasons, is not about knowledge and its potential use for the development of the region, but merely about knowledge being produced for the sake of producing it.

“In Chile the information generated even by the State funded research is not available, meanwhile in other countries, like Norway, the information is available because it is paid by the State. So another obstacle in this is the Chilean research policy, where the university does projects, completes them, and no one evaluates whether the research had any impact, thus you see that there are researches being conducted but the information is not available, so how can you evaluate if it was good or not, and if it had any impact.” (Instituto de Acuicultura, Universidad Austral)

“Within universities you are assessed by the number of publications, and not by the number of projects, hence they go in absolutely different tracks in respect to the firms needs, because the firms need to resolve problems, and have no interest in knowledge or its publication, even more, it is preferable for them if it’s not published at all (...)” (Instituto de Acuicultura, Universidad Austral)

It is admitted, though, that collaboration and interest in developing research comes more often from the small and medium size firms that provide services to the salmon industry (and others) than from the salmon firms themselves. They may be the closest ones to collaborate with the development of a knowledge market. As it was exposed in the theoretical framework, entrepreneurship has been considered a key mechanism for the spill-over of new commercial knowledge (Acs, et al, 2009).

Key Code: “Salmon industry does not learn”

This “enclosure of knowledge” and “lack of oriented knowledge being produced” sensation is also manifested in the view that almost all of the institutions interviewed shared about the salmon industry: being incapable of learning and developing. The salmon industry was often described as a blind one; it keeps repeating the same mistakes, over and over, and deliberately shows no intention to reconsider its path. Therefore it only changes course when forced to do so, by national regulation or natural crisis.

For the majority of the institutions interviewed, this is not a simple feature of incompetence on the industry's behalf but a rather essential aspect of the nature of its concerns. They claimed that the salmon industry does not care about its negative impact or the common wellbeing for that matter, and hence, the state should be in charge of that.

There is a strong association between the notion of "enclosed" and the "lack of involvement of a national policy and funding" that could coordinate and orient the generation of knowledge in the region.

3.6. National-Regional Scale

What we have encountered across all interviews and around the different subjects treated is an underlying call to national policy.

At the centre of most of the network-views generated for each group of institutions interviewed was one of the most linked codes across all interviews: "*no general orientation*" and it was frequently accompanied by "*no long term planning*". Both of these affirmations were usually associated with the lack of governmental involvement in the current state of innovation, knowledge, and of course networking.

Key Code: "*Lack of regional autonomy*"

In some cases the importance of regional autonomy in regards to resource administration was stated as a weak point that needs to be strengthened for a RIS development. From support institutions for instance, it was stated that regional resources and programs are scarce, and that they are mostly appointed and determined by the national government (through CORFO and CONICYT).

However, the demand of regional autonomy was always seen as part of a broader demand for a national plan of development for the regions, and thus was always closely related to the need for central concern and guidance.

Key Code: “*No-one to link initiatives*”

A frequent claim was also made about the lack of any instance of coordination, both on regional and national levels. For the most part, this was seen as a negative factor but the regional bureau of the Ministry of Economy was not in accordance with their view previously detailed. They in fact, celebrated that the salmon industry firms innovate alone, by themselves.

Key Code: “*State funding*”

From research institutions the absence of national policy and funding was also reported as a critical. They stated that because of the low public funding for long term research, each university and department has to produce whatever research the market will finance, which is, as it was explained before, restricted to the immediate and mostly legal need of the firms.

Then again, they claimed that general and long term planning of research led by the State is necessary to prevent the scattered research that is being produced by universities that respond also to the academic need of always producing knowledge in order to remain as a valid academic institution. Currently each firm and university decides their research priorities on their own, as firms do as well.

Finally from municipalities there is even the notion that the salmon industry is actually having more access to public funding than low scale fishing, and this is another reason to antagonize with the industry, given that the salmon industry offers questionable employment and low scale fishing is a traditional main job in the region.

4. Conclusiones of this Chapter

From the qualitative analysis it was possible to obtain some conceptual guidelines based on certain topics that we believe are central factors to the development of a RIS.

First, it is important to note that the salmon industry shows a quite isolated development in the region considering the view of main regional stakeholders. In many cases the exchange of knowledge is only generated to solve specific cases and problems of the industry. This is the case of the institutions of governance and research, which rarely are linked to the salmon industry to generate new knowledge or develop a more qualified human capital. Moreover, support institutions also have a few instances of collaboration with the salmon industry because large companies rarely require access to public funds to carry out its production process or to generate innovation initiatives.

On the other side, most of regional institutions consider that the impact of the salmon industry has been negative for the region, mainly because of poor working conditions offered by the firms, and other negative externalities such as pollution and reduced distribution of the benefits of the industry to the region and its inhabitants. This in turn is reinforced by the perception of the industry as a poorly integrated industry in the region and therefore uncooperative and uncommitted to their development.

However, it should be noted that institutions mostly linked to the support of economic development in Chile such as Ministry of Economy highlights the economic performance of the industry, their ability to grow and reach a state of mature, featured by a highly competitiveness as producer of worldwide food .

It is necessary to highlight the low emphasis given to the territorial conditions and proximity in the region to generate innovation and initiatives for the development of the industry. Many institutions just linked the geographical aspects of the region to local natural conditions to the development of the industry. Moreover, the lack of coordination between salmon firms and the rest of regional institution is emphasized. Most of the instances of collaboration and networking between the salmon industry and regional players have been reduced to occasions in which the salmon industry has to solve specific problems or reach agreements on production standards, health aspects of regulation issues of the industry.

Considering some aspects related to innovation, a common view is that salmon industry is characterized as a not very innovative sector. Besides, innovation networks are not well developed, on the contrary, innovation initiatives are mostly generated in isolation. In this

context, often the knowledge created in innovation initiatives remains retained in the companies and is not shared with other companies and regional actors.

CHAPTER VI: SALMON FIRMS AND REGIONAL INNOVATION SYSTEM

1. Regional Conditions to Salmon Firms innovation

The aim of this chapter is to analyze from the perspective of the salmon firms involved in the salmon cluster if they are favored or hindered by regional conditions to generate innovation in the products or services they deliver. Thus, quantitative analysis of this chapter puts the focus of the analysis on firms and intends to be complementary to the analysis developed in the previous chapter, where it is discussed from the perspective of public and private regional institutions a more global and transversal vision of regional conditions that exist to promote innovation in Los Lagos region. As it will be shown in the following results of this chapter, the responses obtained using a quantitative methodology maintain an important consistency and are commonly shared considering the results of the last chapter, which is based on a qualitative approach to understand the presence of a RIS. However, there are some specific topics that are highly marked by the different perception from salmon firms and regional stakeholders.

2. Descriptive Analysis of Results

In order to link innovation processes and potential impacts that could have regional conditions on the salmon firms, a first characterization of the firms surveyed was performed. As it was specified before, the total amount of salmon firms that participate in the salmon cluster is around 450 firms. Of them, around 15 are large producer firms and the rest are mainly SMEs that provide services and different products in the value chain.

2.1. Characterization of the Salmon Firms

a) Number of workers of the company

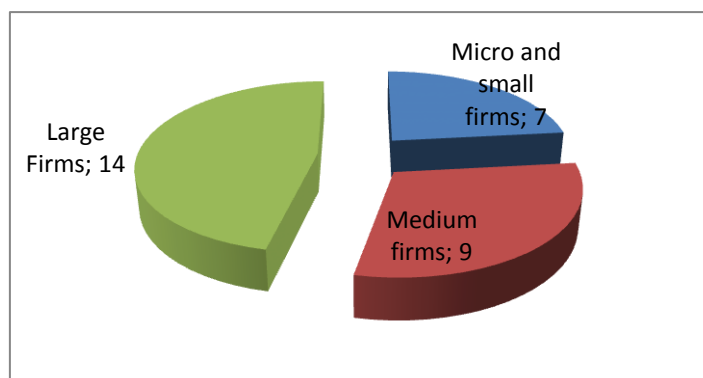
For this variable, data are grouped according to the classification of companies SOFOFA (Sociedad de Fomento Fabril) by the number of workers.

For this classification companies can be grouped according to the number of active workers:

- Large Firms: More than 200 workers
- Medium firms: 5 to 199 workers
- Micro and Small firms: Less than 5 employees

Figure 29

Firms grouped by number of workers



Source: Own Elaboration

Of the 30 companies surveyed, 14 are large enterprises, most of which are producers of salmon. Small and medium businesses are mostly related to specific services in the productive chain of the salmon. It is precisely these companies that often must to generate innovations to provide products and services to large companies and thus solve specific problems and needs of the core business, which is the production and sale of salmon.

b) Approximate percentage of total workforce with higher or technical education

This question considers only direct workers (not sub contract) with both technical and professional academic degree recognized by the state. Of all companies surveyed, the average percentage of educated workers corresponds to 34.47%, meaning less than 50% of workers have higher education. The company with more workers has 93% with higher education, and the minimum 10%.

Certainly, the specialization and degrees of education of employees working in the firms that conform the salmon industry, is a central factor to carry out innovation initiatives, the development of new knowledge and the ability to absorb knowledge that is generated both within and outside the region.

c) Origin Company

This indicator corresponds to the identification of the country of origin of the company, so this is consulted directly if the company corresponded to foreign or domestic capital. This is an important issue since the relevance of foreign firms is quite important in the salmon industry, especially considering large companies that are mainly salmon producers. Many times innovation and new knowledge created by these companies abroad remain in the firms and it is not shared to the rest of the regional firms and regional stakeholders. Besides, new knowledge developed by these companies is internally transferred from abroad to be used it in the region, using internal channels of communications and thus defaulting the spillover of knowledge.

Table 12

Origin of the Firm

	FRQ.	%
National	22	73.3
Foreign	8	26.7
Total	30	100.0

Source: Own Elaboration

Of all the companies surveyed, 73.3% are domestic firms, while 26.7% said it is a foreign company. It is important to note that most national firms, mostly small and medium firms related to, among others, sanitary business, food or transport business have been created to support the core business of the salmon industry, that is production and sale of salmon, mainly performed by large firms highly concentrated in a few large and foreign firms that have been able to overcome most important problems of the industry in Chile; sanitary problems caused by ISA virus and the apparition of new world producers such as Rusia, reducing the cost per kilo of the salmon and thus reducing the incomes of the industry.

d) Type of firm (product process of salmon industry)

As it is shown in the table below, there is an important variety of different firms involved in the production process of salmon and all have a specific function within the value chain. However, the principal activity within the production process is linked to the production of salmon which is supported by a lot of firms that provide various services and develop specific products that are outsourced by main producers.

Table 13

Function in the Salmon Productive Process

	FRQ.	%
Production firms	15	50.0
Supply firms	7	23.3
Laboratory	1	3.3
Hatchery firms	3	10.0
Plant of food	2	6.7
Total	28	93.3

Source: Own Elaboration

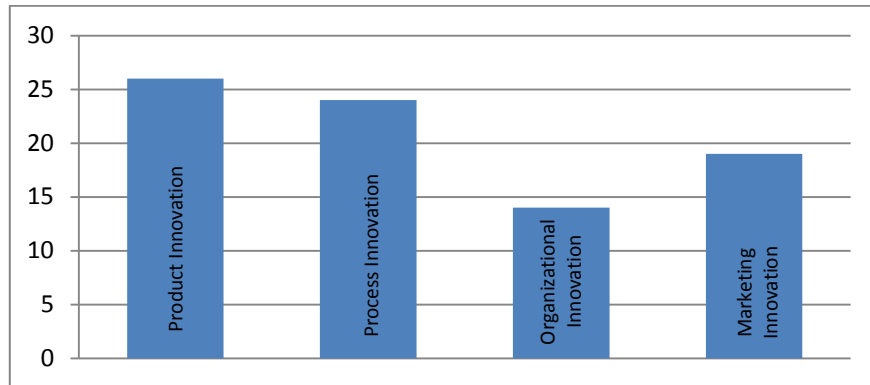
The demand for these services has opened a regional space for the emergence of new businesses and initiatives of entrepreneurs who must constantly innovate to offer new and better services. This premiere coincides with the analysis from regional stakeholders that perceive that SMEs are more innovative than larger companies.

2.2. Type Innovation implemented

This question of the survey tries to understand what kind of innovation is frequently implemented by the firm in the salmon industry. Some of the innovation is related to product innovation and some is related to organizational practises (work practices, organizational model, workplace improvements). It is also considered innovations in the production processes (production line, technology or software production purposes or services) or in their relationship to the market (marketing methods for positioning).

Figure 30

Types of Innovations Implemented



Source: Own Elaboration

From the surveyed firms, 87% of them presented product innovations, followed by process innovations with 80%, marketing innovations with 63% and finally, organizational innovations with 42%.

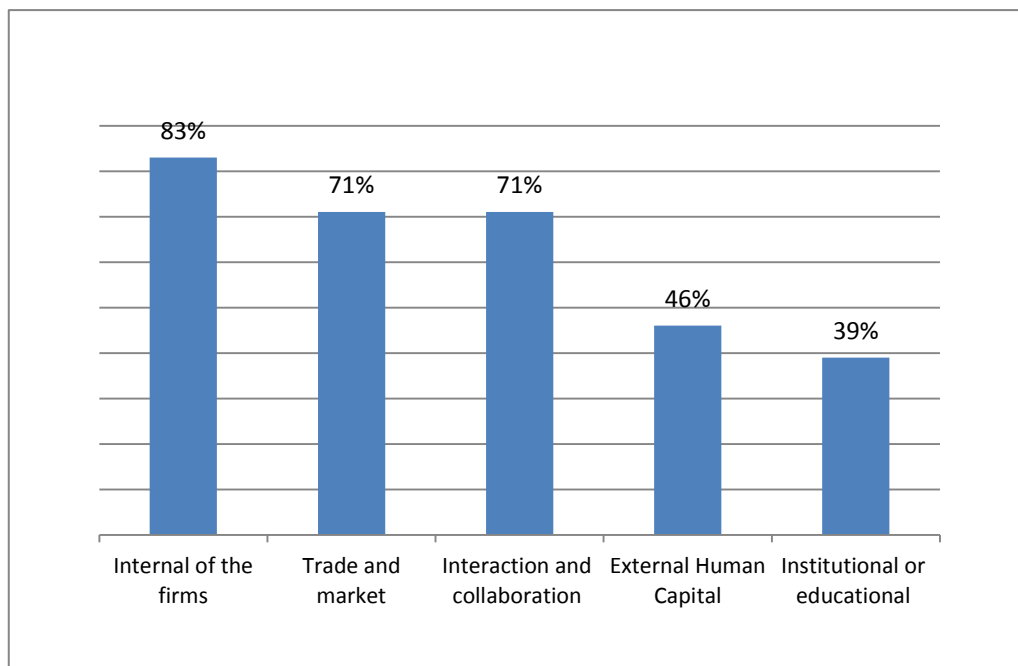
It is important to note that firms surveyed have indicated a significant trend towards innovation, especially in product and process innovations. This fact contrasts with the perception of regional actors that perceive the salmon industry as a very low innovative economic activity. However, this perception may be reinforced because salmon firms, especially large firms, carried out these instances of innovation in isolation. Those initiatives are performed by individual efforts in absence of collaborative activities and later knowledge is not diffused to the rest of regional actors.

2.3. Access to knowledge and information to generate innovations

In order to determine sources of knowledge used to generate innovations, the question was designed to identify in what measure regional sources are key conditions to develop those innovations.

Figure 31

Regional Source of Knowledge used to generate Innovations



Source: Own Elaboration

From the total surveyed firms, an 83% indicated that main source of knowledge used to implement innovation is internal to the firm. Immediately thereafter, 71% of the firms pointed out that utilize knowledge from interaction and collaboration sources to generate innovation. With the same percentage (71%) firms declared to occupy trade and market interactions as a source of knowledge. Just 46% of firms indicated that use external human capital to develop an innovation and finally only 12% declared to use knowledge from institutional and educational source.

The very high percentage of firms that commonly use internal sources of knowledge to generate innovations (it means knowledge from the firm or its business group, personal experiences of workers, meetings or conversations with colleague) strengthens the perception of regional stakeholders that innovation initiatives of salmon firms are frequently performed in isolation. In the same context, 71% of firms pointed out that those innovations were based on knowledge provided by trade and market sources, it means knowledge that result from formal commercial interaction which is part of the value chain and where cooperation and collaborative efforts with regional actors are not mandatory. In other word, knowledge is naturally transferred from new collaborative relationships with clients or consumers or trade relations with other companies in the industry or other business activities as suppliers of equipment, software, R & D laboratories and other distributors or partners.

With the same percentage, 71% of surveyed firms use sources of interaction and collaboration from networks or social capital at the regional level (Information or knowledge provided form informal sources such as family contacts, interpersonal, informal or casual relationships. They may be within the salmon industry meetings such as conferences, presentations of exhibition

The 46% of salmon firms use external human capital (Advanced human capital, senior consulting specialists or specialized employees are hired by the firm), to generate innovations. This use of knowledge implies an important labor mobility from abroad or from the rest of the country when firms have to hire this kind of knowledge. However, main labor mobility within the region is commonly linked to low-skilled employees that perform more standard and basic tasks.

Finally 39% of salmon firms use institutional or educational sources to generate innovations. Thus the knowledge from collaboration with universities or institutions of higher education, exchange projects or collaborative projects based on ideas generated in universities (spin-offs) is very low when is compared with the resto of the knowledge sources. In the same context, it is very coherent with the lack of regional conditions to generate innovation the low use of sources of knowledge provided from public or private institutions in the Los Lagos Region, NGOs, collaborative projects, business associations, national or international institutions with regional presence (ministries, NGOs, etc.).

2.4. Awareness of Regional Innovation System in Los Lagos Region

The following set of statements is related to the level of importance assigned by salmon firms to the presence and importance of RIS to generate innovations:

Table 14

Networking and Associativity with Firms within the Regional Salmon Industry

	FRQ.	%
Very Important	27	90.0
Unimportant	3	10.0
Total	30	100.0

Source: Own Elaboration

Regarding the statement “Networking and associativity with firms within the regional salmon industry”, 27 firms consider that it is a very important issue. For only 3 firms it is an unimportant element in the regional context. Those results are contrary to the most common perception of salmon firms provided by regional actors that consider salmon firms as a very isolated actor, both, in the regional context and with the rest of the firms of the salmon industry.

In the perception of regional actors, networking and associativity are rarely performed by firms because much of the knowledge required to develop innovations are provided internally by the firms or firm group. However, it is important to note that the statement is linked to “networking and associativity among firms within the salmon industry” and not necessarily with the rest of the regional actors. In that case, would be more important the features of an insulated salmon cluster than the regional conditions to promote innovation.

Table 15

Access to sources of Information and Regional Knowledge Spillovers

	FRQ.	%
Very Important	28	93.3
Moderately important	2	6.7
Total	30	100.0

Source: Own Elaboration

Regarding the access to sources of information and regional knowledge spillovers, 28 firms considered that it is a very important element to promote innovation. It means that are commonly used to generate innovations spin – offs, labor mobility, formal or informal interactions or transactions from other firms or from the regional context. Considering the information provided for the point 2.4, main source of knowledge used to innovate is linked to trade and market and interaction and collaboration. Regarding the same point, labor mobility does not appear to be very important as a source of knowledge in the regional context.

Table 16

High Expertise and Knowledge in the Salmon Industry

	FRQ.	%
Very Important	24	80.0
Moderately important	3	10.0
Unimportant	2	6.7
Total	29	96.7

Source: Own Elaboration

Regarding the “high expertise and knowledge provided for the salmon industry”, 24 firms consider that it is a very important regional element for firms. Contrarily, 2 firms consider that those sources are unimportant and 3 claim that they have a moderately important in the region. As we have noted before, the consolidation of the salmon cluster in the region has

allowed a high specialization of knowledge in this economic area that could be used by the regional firms to generate innovations. For example, an important specificity of salmon firms that provides a very specialized service in the salmon value chain or very specialized human capital provided for regional universities which are subsequently recruited by salmon firms.

Table 17

Support (financial, research, training, etc.) of Public and Private Institutions

	FRQ.	%
Very Important	19	63.3
Moderately important	9	30.0
Unimportant	1	3.3
Total	29	96.7

Source: Own Elaboration

Finally, only 19 firms consider that public and private institutional support is very important at regional level, 9 firms consider this support as a moderately important and 1 firm as an unimportant element to promote regional innovation. In this question the issue of the isolation of the salmon firms with the rest of regional institutions is reinforced. That also stresses the lack of coordination initiatives and interaction between regional actor and salmon firms to promote innovation. As we noted in the qualitative analysis, the lower interaction of salmon firms with regional actors is with educational and research institutions when some innovation is required to solve a specific problem or improve the productive process.

2.5. Main Obstacles to Innovation

Following data provides information about the perception of salmon firms related to the level of importance attributed to different obstacles that may be present in the region hampering the implementation of innovation activities in the firm. It is important to note that this information is a key data to analyse if the development of the salmon cluster has

contributed to generate the conditions to promote a RIS. The grade of development of those conditions can be also viewed in the perception of the salmon firms as a factor to promote innovations by salmon firms but also as a regional obstacle to foster the generation of new knowledge.

Table 18

Lack of Funding from External Sources

	FRQ.	%
Very Important	14	46.7
Moderately important	7	23.3
Unimportant	8	26.7
Total	29	96.7

Source: Own Elaboration

An important regional condition to promote innovation in salmon firms is linked to the facility to access to regional funding from productive development institutions or other external sources to perform new commercial knowledge. In this context, asking for the importance assigned to these financial sources to promote innovation, 47% of the firms consider that this condition is a very important regional obstacle that hampers initiatives of innovation.

As we have seen before, commonly in the region the development of innovation by large salmon firms is based on internal sources of knowledge and also on internal financial resources. In this context, large firms are not closely linked to productive development institutions of the region. On the contrary, SMEs that have to continually innovate in order to provide external services to the salmon productive process, commonly demand a better access to regional financial funds and better channels of interaction with those institutions.

Table 19

Lack of Qualified Staff

	FRQ.	%
Very Important	20	66.7
Moderately important	3	10.0
Unimportant	7	23.3
Total	30	100.0

Source: Own Elaboration

The lack of skilled labor to work on the production process salmon is considered by 66% of salmon firms as a major obstacle to generate innovation employees. In this context, it is important to address that regional lack of highly qualified employees has generated significant labor mobility, especially professionals who should occupy key positions in salmon firms and come from other regions or countries to perform specific tasks that require high specialization.

In other cases, firms hire professionals who study at universities in the region and have adapted their curriculum to technical and professional requirements demanded by the salmon industry. However, although 66% of salmon firms consider the lack of qualified staff as an obstacle to promote regional innovation, specialized human capital in the region is considered in the fourth place as a source of knowledge for innovation.

Table 20

Difficulty in finding Firms to generate Collaboration or "networks" to Innovate

	FRQ.	%
Very Important	20	66.7
Moderately important	4	13.3
Unimportant	5	16.7
Total	29	96.7

Source: Own Elaboration

As we noted above, the perception of most regional actors regarding the salmon industry is that firms tend to generate innovations to improve its production process in isolation in the region. One of the reasons that can explain this fact is the difficulty faced by the firms to create links with other regional companies in order to collaborate and generate innovations networks. In fact, 67% of companies believe that this factor is a regional obstacle to generate innovations.

Table 21

Lack of Trust to Initiate Collaborative Projects

	FRQ.	%
Very Important	22	73.3
Moderately important	5	16.7
Unimportant	2	6.7
Total	29	96.7

Source: Own Elaboration

As we noted in the theoretical framework and throughout this research, an environment of trust between regional stakeholder and especially among firms is a decisive factor to generate innovations based on collaborative projects. However, as shown in Table 32, the lack of confidence to collaborate and generate innovation is considered by 73% of surveyed firms as a major obstacle for salmon industry.

Table 22

Lack of Support from Regional Institutions

	FRQ.	%
Very Important	23	76.7
Moderately important	4	13.3
Unimportant	2	6.7
Total	29	96.7

Source: Own Elaboration

Another important factor that is considered by 77% of salmon firms as an obstacle to generate innovations is linked to the lack of support from the various regional institutions. Instead, the perception of regional actors is that firms are only interested to coordinate and interact with regional institutions to solve specific problems mostly related to regulatory and health aspects.

Figure 23

Lack of regional policies to develop the Salmon Industry

	FRQ.	%
Very Important	20	66.7
Moderately important	5	16.7
Unimportant	4	13.3
Total	29	96.7

Source: Own Elaboration

Finally, there is a negative perception of salmon firms regarding the lack and need to generate public policies that support regional innovation actions carried out by salmon firms. An important factor to consider this is the lack of autonomy of the region to generate an adapted regional innovation policy in line with the territorial reality. On the other hand, the strategic changes in the focus of a national public innovation policy in the last twenty years can also hampered the action of specific regional programs and projects performed for national and regional institutions to promote innovations in the region. In fact, about 70% of firms believe that this regional condition is an obstacle to generate innovations.

3. Conclusions of the Chapter

From the analysis in this chapter, it was possible to know the perception of salmon firms about regional conditions to promote innovation in firms. Interestingly, in some aspects related to the main sources of knowledge to generate innovation and major regional barriers that encourage firm innovations, salmon industry vision contrasts with the perception of key regional actors.

First of all, it is interesting to note that while the salmon industry is considered by regional actors as a very low innovative economic activity, 87% said they make product innovations and 80% carried out process innovations. Likely, the reason why the perception of regional institutions of this industry is very innovative could be due to the isolation that these innovations are developed, especially those carried out by large companies.

Regarding regional sources of knowledge used to generate those innovations, the use of internal knowledge of the firms was considered as the most important followed by knowledge provided automatically through trade and market interactions. This fact is consistent with the perception of regional actors considering the isolation to generate innovation. However, it is important to highlight that also 71% of firms declared have used knowledge from interaction and collaboration project with other firms and institutions.

Considering the perception of salmon companies regarding the existence of a RIS in Los Lagos region, 90% reported that the networks and associativity among salmon firms was very important to generate innovations. Moreover, 93% said that access to information sources and knowledge spillovers was also very important to carry out innovation processes. Again, the emphasis placed on these sources of regional knowledge to generate innovation, contrasts with the perception of regional actors regarding the self-sufficiency of companies and the low interaction and necessity to use certain regional inputs to innovate.

Finally, the main factor considered as an obstacle to innovation by the surveyed firms, was “lack of institutional support”. This factor was considered as a “very important” obstacle that diminishes the possibilities of generating innovation activities by the firms of the salmon industry. It includes all of the institutional support given by various state and / or government agencies, and entities related to economic promotion activities at the regional level to enable the development of innovation in the salmon aquaculture industry.

CHAPTER VIII: CONCLUSIONS

From the analysis carried out by this research, results show that the consolidation of the low-tech Salmon Cluster in the Los Lagos region has not developed the principal factors that permit the apparition of a RIS; on the contrary, regarding a RIS approach to analyse the national and regional innovation policies, the functional organization and the history of the salmon industry in Los Lagos and also the view of the main regional actors, public and private institutions, there are important gaps in terms of the regional conditions to foster innovation in salmon firms. In this case, the business development and innovative behaviour of a competitive rural industry such as the salmon industry has not generated the minimum conditions for the promotion of a RIS (Norhona Vaz, 2011).

It is important to emphasize some contradictions resulting from the quantitative and qualitative empirical analysis carried out using as a unity of analysis on one hand regional institutions and on the other salmon firms. Most significant differences are linked to dissimilar visions considering the importance attached to some regional elements such as networking, partnership and knowledge spillovers. While salmon firms claim the importance of regional elements and conditions to generate innovation, regional institutions consider the salmon industry as an isolated economic sector that do not requires interaction to generate innovation, especially large companies that mostly use domestic sources of knowledge to start innovation processes.

In that context, following topics below can be summarize main findings of quantitative and qualitative empirical analysis in the context of the development of the cluster salmon and regional conditions that it has provided to the promotion of a RIS from the view of regional institutions and firms of the salmon industry;

1. Mayor Bottlenecks

From the examination of quantitative and qualitative analyses carried out from the empirical data, many actors frequently shared the view about the negative impact that the salmon industry has on the region, as well as its unwillingness to seriously change that role. It is an industry perceived as uncooperative, enclosed, arrogant, and so on.

Most of these features could be attributed to the manner in which other big low-tech or extracting industries in Chile seem to have chosen to conduct their work. This way of producing however, is every day more disapproved and sanctioned by the local communities and local authorities.

This association of “salmon industry-enemy” and “state-ally” regarding for example the low audit activities on environmental impacts that the industry produces in some of their productive process, is highly problematic since in contrast, while the salmon industry is regarded as an industry that does not care about common well-being (which also includes regional development, employment, innovation and long term planning), the State is regarded as the one that is accountable for it. In this sense it is agreed that while firms are concerned and respond to only immediate and individual necessity, the state has to, whether from a regional or national scale, be in charge of common and long term well-being.

This antagonizing scenario is a profound obstacle for the development of a RIS in the region, where, as it has been previously exposed, trust is at the base of an integrated system where the notion that economic success of firms is a desirable factor for the development of the region also has to persist.

Commonly, firms linked to the salmon industry are innovative; a large majority of them said they have developed process and product innovations. However, it is important to mention that especially large firms make this innovation to adapt their productive processes and products to international healthy standards that are demanded by main destination markets. On the other hand, large firms have to adapt their product and services to Chilean legislation that has gradually changed to increase labor regulation and environmental local impacts of the industry.

Additionally, many of these innovations have emerged in response to the negative perception that generated the salmon industry both in some institutions of government and the community, based mainly on the perception that the industry has a poor integration with the community and the negative externalities of the production process are not taken responsibly by companies.

At this point it is important to mention that in many cases the comparative advantages of Chile; as the low price of labor and the low level of expenditure relating to the care of the environment, have not pushed firms to innovate systematically in order to increase their low levels of productivity that presents the industry with respect to Norway, its main competition. Thus, there has not been a critical need to generate new marketable knowledge to improve or replace internal factors of production in order to meet production demand.

Additionally, it is important to note that large firms in order to generate innovations, mainly use internal knowledge and resources of the company which does not promote a more intense and systematic interaction with the various regional institutions

In this sense, it is possible to observe a high degree of concentration of capital in the salmon industry where few companies are leading the industry, they are innovative and are supported by a regional platform of institutions both in the area of productive development, control, training and research.

However, although it has built a network of institutional support to sustain the industry, this support is not required by the industry itself, it means that the need for support does not come from the companies, and therefore the vision of regional institutions it is that the industry operates in isolation even though there is indeed an institutional offer to support innovation.

By contrast, regional SMEs, involved as providers of the productive chain of the salmon industry, require greater access to support of various regional institutions, primarily to improve services, increase their competitiveness in relation to other suppliers and adapt their services to constant requirements demanded by salmon producers, mainly large firms.

Despite the high competitiveness and specialization that has reached the salmon industry in Los Lagos region, generating approximately 40,000 jobs and the possibility of promoting opportunities for economic entrepreneurship for micro and small businesses that are incorporated into the production process industry, it is important to note that both the negative perception of all regional actor (and the community), and low economic indicators linked to economic growth in the region, do not give account of a significant contribution of industry to the region, especially because of the isolation of large firms to develop the industry, the low integration with the local community and the negative externalities and environmental impact of the industry on the territory.

2. Innovation

Innovation seemed to be associated with a business orientation that restricted it to the realm of firms, and in there, to the availability of resources and technology. This association of Innovation-capital-technology leaves out any notion where regional non-profitable institutions might be subjects or participants of an innovation process. Consequently the institutions asked delegated innovation as a practice to the firms and hoped but not expected that it might have some positive impacts on the region.

Innovation is considered by regional actors as poorly depicted; centered on the acquiring of technology mainly, but mostly was a void concept, removed from any concrete experience or profound knowledge of its systemic approach. There is however a shared view among research and support institutions that innovation is needed to reduce the negative impacts of the industry in the region. Although in order to undertake this task, the efforts needed are attributed as a responsibility beyond firms, in the form of public funded knowledge, more regulation, and so on.

3. Knowledge Spillovers

There is a common notion that knowledge produced for the industry is attained from abroad and remains enclosed within the big firms that can afford it. In addition, it was

stated that the knowledge produced in the region is being generated by the universities mostly, and that it is often aimless, due to the lack of public funding and lack of general orientation, leaving an open field for each institution to define their priorities.

It was in the research institutions as expected, where a more present concern was found about innovation and the development of a regional based knowledge center that could nurture the local industry and community in general.

4. Networking

There is a conflicting view on the necessity of networking in the region. As it was exposed throughout the document, contrary to the most commonly shared view across the regional actors, there is an idea that close linkage between firms and other regional institutions is not desirable for the development of the industry.

Therefore the widespread feeling of abandonment that most institutions expressed in regards of promoting networking seems to be a natural reaction to the actual change in a formally cluster based policy of development for the region.

In the region the need for association and collaboration remains highly regarded and thus, the lack of governmental initiatives to attend to that need is also enormously felt. The memories of former instances of collaboration are proudly and emotionally missed, while the current “freedom of action” is regarded as mere voluntary absence on the state’s behalf.

5. Beyond the Salmon Industry

As it has been exposed and confirmed by the image retrieved from regional actors, the salmon industry, while offering some conditions of a cluster, such as territorial proximity and a strong path dependency, seems to prefer:

- e) To remain as a segregated industry, enclosing a small group of the bigger firms and excluding the rest of the industry (leading to ultimately terminating it),

- f) To remain as an extracting and short term industry, and
- g) To remain isolated from the regions' institutions and community.

Considering this industry disposition, the perceptions of almost all regional actors, and the support of the national policy (expressed in its current non-interference), one could argue that the salmon industry has disseminated and reinforced the notion that low-tech industries are harmful for the region's development and thus, deepened the distrust towards big "successful" firms.

However, some conditions or rather pre-dispositions were found favourable for the development of a RIS in the region allocated in smaller entrepreneurship that could be further explored.

Smaller and medium size firms in the region were depicted by many institutions as innovative, supportive of knowledge generation in the region and more integrated with the regional institutions. They were identified as mostly service providers, related to the salmon industry but not exclusively.

On the other hand, innovation is a rather limited and empty concept for most of the institutions interviewed but this is something that can be changed with appropriate policies, and meanwhile, the need for more integration of institutions, community, academic, state and private sector is widely spread across most of the regional actors. Also in contrast with the case of innovation, networking is not a void or fashionable concept, but a strategic alternative appropriate for the problems that these institutions and the smaller firms experience.

6. Perspectives of Regional Development

Through the analysis of the functional organization of the salmon industry it is possible to note that this activity has defined specific areas of action and development. The areas where various stages of salmon production are performed acquire specific territorial characteristics that are possible to be visualized in form of defined organizations and specific spatial patterns. It is important to understand these spatial implications arise from

this activity. It is from this knowledge that it will be possible to initiate positive actions leading to increasing social development.

In the Los Lagos region, the spatial effects are noticeable mainly on the infrastructure that has been built in order to increase road connectivity and access to the one of the stages of the productive process incorporating areas that twenty years ago were relatively isolated. Following this, it is also possible to show a significant increase in traffic flows (also air and maritime flows around the salmon activity), mainly linked to the activities of support services such as transport workers, supplies and other products.

It is important to highlight the high impact that some of the stages of the salmon industry productive process have when they are located in specific areas in the Los Lagos region. However, many times this activity is developed in the territories only in a functional way using specific areas of maritime concessions and not interacting with coastal zones because all the support is provided by maritime zones, such as food, workers, etc. In other cases this interaction with the territories is the link generated from job offers of the salmon industry, commonly featured by fragile and temporal labor conditions that may increase considering the reduction of work placed because of the automation of production processes and the possibility that this activity reduces its scope or simply disappears from some areas to relocate in other areas or regions.

For this reason it is important to create lines of action and regional strategies to be prepared for any external conditions that may affect the salmon industry (such as ISA virus in 2009) reducing employment and negatively impacting areas where a high percentage of employment is provided by this activity. It is really relevant in this context to generate various mechanisms and tools that tend to join forces to achieve a regional development not only based on a monoculture production, but in a coherent set of territorial, social, economic and institutional factors conforming a platform for regional development based on current and new potentialities of the region. The territory must be able to carry out a process of endogenous development and internalize the external opportunities as are represented by the salmon industry.

Regional development should be inserted in a process of a state modernization, the promotion of regional production and innovation, the link between public and private sectors and a regional decentralization where all these processes may converge in the territory, in an enclosed space of action with particular characteristics. The idea that the territory is only one arbitrary spatial limitation by administrative and political divisions should dissipate.

However, in order to carry out this task, a productive and institutional restructuring a strategic conciliation of regional actors and the creation of an innovative and creative space, organizational flexibility and new considerations of the territory are all needed, now seen not only as a physical support to economic and social activities, but as an expression of organization and mobilization of cohesive local social actors trying to achieve their own development.

7. Opportunities

The existence of the Regional Salmon Cluster is an opportunity to generate socioeconomic development in terms of the improvements in the area of products, production processes, infrastructure and human resources. Despite a cluster policy being initiated in 2002, this option was ended in 2010 trying to support all regional economic activities and not privileging one activity over others. That means that regional development is only the result of market demands and the only factor to increase and promote specific activities to the detriment of planned industrial economic strategies supporting a regional specialization or at least a long term industrial policy. In this case these facts cannot be reduced to the discussion of specialization versus regional diversification and should be seen as de complete absence of regional industrial policies corresponding with the ultra liberalization of markets policies in Chile.

In the region there are still important lack of linkages among economic activities and a lack of knowledge of the regional economic actors regarding current and future potentialities and opportunities. The productive diversification can be seen from the perspective of the creation of additional activities to the salmon industry to establish new axes of regional economic growth.

In this context, it is also essential to know sectoral linkages of the salmon industry both forward and backward to promote regional development. It is necessary to strengthen the Salmon Cluster activity as a diffusive factor of value chains, generating flows of knowledge, investments and dynamism.

The effect of the salmon cluster may produce market connections, access to new technologies and specialized goods and services. The opportunity for the salmon industry as a strategic economic axe of action is mandatory to guide and promote innovation, business aspects, management and administration of new ventures. There is not another regional economic activity in a better position to lead the installation of a renewed RIS based on a regional cultural mentality focused on innovation and creativity as the motors of the regional development. However, this process will require deep public support, public and also private institutions, industry associations and institutions that provide economic and financial services must be mobilized around this opportunity.

In this sense, it is interesting to note the significant outsourcing by the salmon industry in many economic activities associated with their production systems. Safety, transportation, food, vaccinations, etc. are part of the activities that provide and supply small and medium-consolidated subcontractors, which are mostly from medium-sized cities in the region. However, often these subcontractor firms have contracted workers already selected from the origin cities of the company promoting intraregional temporal migration of workers corresponding to the low or high seasonality of the salmon productive process. In this case large salmon companies do not contract local workers in the place where activities of the production process are located. It is also important to note that the service externalization of labor supply carried out by these subcontractor companies allows for salmon companies to avoid legal and economic costs related to the maintenance of minimum labor conditions in an activity that is marked by the high seasonality and temporality of the work. These companies act also as equipment support specialists moving through different salmon companies offering their services.

The discussion around the possibility of having a special focus in regional investments cantered in a specialized economic activity or by the contrary supporting a diversified economy is still open. Currently regional policies in Chile are inclined to generate structural conditions to the development of economic alternatives for monoproducer

regions that have been not capable of getting a diversified economy, being exposed to a total crisis in the case that production and exportations could be affected by the reduction of the global lack of market demand.

This is why it is absolutely necessary to create new forms of development associated with RIS, where entrepreneurial vision and innovation is the critical factor in the territory aimed to generate a business network able to sustain, consolidate and enter into the market under various forms of production.

Undoubtedly, the existence of the Salmon Cluster can promote an early stage of learning and development activities based on this key industry and its requirements consolidating then an economic, social and an institutional platform able to complement and build new economic axes diversifying the regional products and services in a second stage to the consolidation of a RIS.

8. Future Research

In the present study we have provided empirical knowledge about the possibility of creating a RIS from regional conditions that have resulted in the development process and consolidation of the cluster of salmon in the region characterized as an activity that requires a low knowledge creation, technology and innovation since its development is based on the efficiency to carry out the production process and the existence of specific natural advantages. Indeed, it is interesting to note that the results of this research suggest the difficulty that this cluster has to create conditions that promote innovation in the region, but nevertheless can be promoted through an efficient RIS policy that emphasizes regional characteristics and specific solutions to overcome major gaps identified.

The salmon industry in this regard should take a new step of development based on sustainability and harmonious development in conjunction with other regional actors and certainly be able to transfer the positive externalities of the industry to the rest of the region and its inhabitants.

In this context, future research should be linked to the generation of public policies capable to improve the main identified gaps and enhance those that are positive for the region and for the promotion of a RIS. Although the present study attempts to shed light on the possibility of generating a RIS considering the advantages that could be the result of the development of a cluster based on the use of natural resources and low creation of new knowledge and innovation, it is necessary to develop new research that allow to main regional stakeholders take advantages of those potential conditions through focused public policies that foster the creation of an environment of regional innovation used by other economic activities in order to boost regional economy, economic growth and social development.

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Annex 1. Interview Guide

Firms and Innovation

- How this institution is specifically related to the salmon industry?
- Is it innovation in the salmon industry a concern for your institution?
- Which is the role attributed to innovation in firms to enhance the region competitiveness?
- In your opinion, taking into account the different productive stages of this activity, are there many differences in terms of innovation between small and bigger firms?

Knowledge: sources, circulation and transference.

- Are the knowledge and spaces generated by your institution, being used by the firms in the development of innovation and entrepreneurial processes?
- What could facilitate the circulation and absorption by the firms, of the knowledge generated by your institution, in order to create new regional entrepreneurship and competitiveness?
- In your opinion, beyond commercial relations required by firms, which are the main sources of knowledge used by them on a regional level to generate innovation processes and entrepreneurship? (Commercial associations, collaborative spaces, friendships, etc.).
- The knowledge that is regionally required to generate innovation is effectively disseminated or remains withhold within firms and local institutions?

Interaction and networking

- In your opinion, is there any intention among different actors of this activity, to interact and generate collaborative or associative projects to generate innovation for the industry?
- From a regional perspective, what is the relevance of the fact that this activity takes place in a determined region? Is geographic proximity between actors a significant factor in the development of this activity?
- In your opinion, what is the importance of participation and collaboration in regional, national or international networks (formal and informal), for competitiveness of firms?

Regional Innovation System

- Does your institution participate in regional collaborative work instances that include all actors involved in this activity? Or do you work rather isolated?
- Is there an innovation and learning culture or environment in the region that promotes innovation in firms, in the public sector and in all other business that have some relation with salmon industry?
- It has been this activity characterized by strong ups and downs in its course. In what way have institutional learning processes functioned towards facing the industry's challenges? (e.g. collaborative solutions)

- Does your institution estimate that current national policies for regional development and de-centralization, allow the generation of a RIS based on salmon industry? In what direction?

Annex 2. Interviewed Institutions

INSTITUCIONES				
(De qué forma promueven o fomentan la innovación, que puede estar vinculada a las instituciones de fomento).				
Instituciones de Gobernanza				
Subsecretaría Pesca ¹	de	Depende del Ministerio de Economía, Fomento y Turismo.	1. Implementar las políticas nacionales de pesca y de acuicultura, a través de instancias de coordinación público privadas con el fin de fortalecer los planes de acción y estrategias del sector. 2. Propender a la sustentabilidad de la actividad pesquera y de acuicultura, por medio de una normativa basada en informes técnicos fundados, para la adecuada y oportuna administración de los recursos. 3. Entregar financiamiento a través de proyectos de investigación pesquera y de acuicultura, y programas de fomento, promoción y capacitación, para contribuir al desarrollo de las actividades del sector. 4. Prestar apoyo técnico por medio de la participación en instancias internacionales pertinentes a fin de posicionar los intereses nacionales en el ámbito de la	<p>MISIÓN: Promover el desarrollo sustentable de la actividad pesquera y de acuicultura, definiendo políticas y aplicando normativas, que incrementen los beneficios sociales y económicos del sector, para el bienestar de las generaciones presentes y futuras del país.</p> <p>PRODUCTOS ASOCIADOS A EJES ESTRATÉGICOS</p> <ul style="list-style-type: none"> • Políticas Nacionales para la actividad pesquera y de la acuicultura. • Normas regulatorias para la actividad pesquera y de acuicultura • Financiamiento para el desarrollo sustentable de la actividad pesquera y de la acuicultura • Asesoría Técnica en materia pesquera y de acuicultura a nivel internacional
Innovación acuicultura	y	Creación del Servicio Nacional de Pesca (Sernapesca) y la Subsecretaría de Pesca por Decreto Ley N° 2442 del 29 de Diciembre de 1978, Con ello se modifica la institucionalidad pública pesquera existente hasta ese momento. Posteriormente, como respuesta a las modificaciones de la Ley de Pesca, publicadas en 1992, a través de la Ley N° 18.892, Sernapesca debió reestructurarse, para hacer frente a los nuevos desafíos ambientales y las exigencias de un		

¹ Ver Política Nacional de Acuicultura.

	comercio internacional dinámico y globalizado.	pesca y la acuicultura.	
SERNAPESCA Servicio Nacional de pesca		<p>1. Fiscalizar las actividades pesqueras y de acuicultura velando por el cumplimiento de la normativa legal y reglamentaria establecida para el sector.</p> <p>2. Garantizar la calidad sanitaria de los productos de exportación, a fin de dar cumplimiento a los convenios sanitarios de países importadores de productos pesqueros y de acuicultura.</p> <p>3. Fortalecer el cumplimiento de la normativa legal y reglamentaria velando por el estatus sanitario y ambiental de la acuicultura.</p> <p>4. Proveer información sectorial oportuna y fidedigna para la toma de decisiones de las autoridades sectoriales.</p>	<p>MISIÓN: Fiscalizar el cumplimiento de la normativa pesquera y de acuicultura, nacional e internacional, que contribuya con el desarrollo sustentable del sector pesquero nacional, a través de estrategias de monitoreo, control y vigilancia sectorial.</p> <p>PRODUCTOS ASOCIADOS A EJES ESTRATÉGICOS</p> <ul style="list-style-type: none"> • Fiscalización de cumplimiento de normas • Certificación y autorización de productos pesqueros • Prevención, vigilancia y control sanitario de la acuicultura • Información y estadísticas sectoriales integradas • Transferencia al Fondo de Fomento para la pesca artesanal
SERVICIO DE SALUD DEL AMBIENTE, SEREMI, REGIÓN DE LOS LAGOS.	Departamento de salud del ambiente. Subsecretaría de salud Pública, Ministerio de Salud.	<p>Adecuada calidad de agua para consumo humano.</p> <p>Minimización de emisión de contaminantes atmosféricos.</p> <p>Adecuada disposición final de la basura.</p> <p>Tratamiento y disposición segura de aguas servidas y excretas.</p> <p>Uso seguro de productos químicos desde la producción hasta la eliminación.</p> <p>Preparación y respuesta frente a emergencias y desastres en materia de Salud Ambiental.</p>	<p>MISIÓN: minimizar y/o controlar la exposición de la población general a factores de riesgos ambientales que dañen, afecten o perjudiquen la salud de dicha población.</p> <p>Depto. Salud Ambiental. El Departamento de Salud Ambiental es el encargado de realizar las funciones de ejecución, control, formalización y fiscalización de las disposiciones sanitarias, sanitaria ambientales y laborales que el Código Sanitario y normativa general asigna a la Seremi de Salud.</p>

DIRECCIÓN DEL TRABAJO	Ministerio del Trabajo y Previsión Social.	<p>1.- Aumentar la cobertura de empresas fiscalizadas.</p> <p>2.- Aumentar la cobertura y oportunidad de las instancias de prevención y solución alternativa de conflictos laborales.</p> <p>3.- Aumentar y mejorar el acceso, la oportunidad y la entrega de productos y servicios de la Institución hacia los usuarios.</p>	MISIÓN: Velar por el cumplimiento de la legislación laboral, fiscalizando, interpretando, orientando la correcta aplicación de la normativa y promoviendo la capacidad de autorregulación de las partes, en la búsqueda del desarrollo de relaciones de equilibrio entre empleadores y trabajadores.
DIRECTEMAR Dirección General del Territorio Marítimo y de Marina Mercante	Armada de Chile		MISIÓN: organismo de la Armada, mediante el cual el Estado de Chile cautela el cumplimiento de las leyes y acuerdos internacionales vigentes, para proteger la vida humana en el mar, el medio ambiente, los recursos naturales y regular las actividades que se desarrollan en el ámbito acuático de su jurisdicción, con el propósito de contribuir el desarrollo marítimo de la nación.
CONAMA Comisión Nacional del medio ambiente	Ministerio del Medio Ambiente		
Comisión Nacional de uso de Borde Costero	Subsecretaría de las fuerzas armadas, Ministerio de Defensa.		MISIÓN: Lograr un Chile conectado al mar por medio de su Borde Costero, donde el Estado a través de sus Gobiernos Regionales, analiza y concede derechos de uso de los recursos y oportunidades que éste ofrece. Lo anterior desde una perspectiva integral, dinámica, multidisciplinaria, sustentable y sistémica, que permita proyectar su desarrollo, crecimiento armónico, e integración de todos los sectores que lo administran, con el fin superior de alcanzar una mejor calidad de vida para toda la sociedad chilena.
Gobierno Regional Los Lagos			MISIÓN: Gobernar la Región de Los Lagos, liderando a las instituciones descentralizadas y desconcentradas, estableciendo alianzas Público-Privadas, para avanzar en el desarrollo armónico y equitativo de su territorio, mejorando la calidad de vida de sus habitantes.
INSTITUCIONES DE FOMENTO PRODUCTIVO			

Fundación Chile	Creado como un organismo público en 1976 por el gobierno de Chile para generar nuevos recursos basados en las compañías. Ha sido crucial en el desarrollo del sector de acuicultura en Chile introduciendo tecnologías extranjeras en las empresas nacionales. Pionero en la generación de actividades de investigación y la prestación de asistencia tecnológica y la difusión de los nuevos productores que estimulen tanto la generación de nuevas empresas de salmón principalmente en las etapas de alimentación y el procesamiento.		Organización privada, sin fines de lucro, al servicio de la innovación y emprendimiento en nuestro país. Nuestro propósito es dar respuestas tecnológicas de alto impacto a necesidades sociales y oportunidades de mercado detectadas.
CORFO	Corfo es un organismo ejecutor de las políticas gubernamentales en el ámbito del emprendimiento y la innovación, a través de herramientas e instrumentos compatibles con los lineamientos centrales de una economía social de mercado, creando las condiciones para lograr construir una sociedad de oportunidades.	Focalizada en nuevas oportunidades de negocios, innovación en la industria, científico y tecnológico, promoviendo la cooperación pública y privada y la asociatividad con las universidades y otros agentes regionales. Distribuye fondos para el desarrollo de investigaciones para apoyar proyectos de desarrollo e innovación.	MISIÓN: Fomentar el emprendimiento y la innovación para mejorar la productividad de Chile, y alcanzar posiciones de liderazgo mundial en materia de competitividad.
IFOP: Instituto de Fomento Pesquero	El Instituto de Fomento Pesquero es creado en 1964 por la Corporación de Fomento de la Producción, CORFO, y la Sociedad Nacional de Pesca. El Instituto de Fomento Pesquero es una Corporación de Derecho Privado, sin fines de lucro. IFOP cumple el rol público de apoyar el desarrollo sustentable del sector pesquero y acuicultor nacional. Actualmente se encuentra bajo el Sistema de Gestión de Calidad (SGC) en el proceso de manejo de datos biológicos pesqueros.	Generar y disponer de conocimiento e información científica indispensable para la definición de medidas regulatorias que fortalezcan la sustentabilidad y la producción de los recursos hidrobiológicos de explotación industrial y artesanal de la acuicultura y la pesca. <ul style="list-style-type: none"> • Garantizar la difusión, actualización, resguardo y calidad de la información de carácter público generada por IFOP. • Proporcionar apoyo técnico calificado en el resguardo de los intereses del país en las instancias nacionales e 	MISIÓN: Apoyar la toma de decisiones de políticas de la institucionalidad pesquera nacional mediante la elaboración de antecedentes científicos y técnicos de valor público necesarios para la regulación y conservación de los recursos de la pesca, acuicultura y sus ecosistemas. Rol estratégico del Instituto de Fomento Pesquero (IFOP) se basa en la capacidad de generar, desarrollar y transferir conocimiento útil, que permita a nuestro país y a la industria nacional posicionarse, competitiva y sustentablemente, en el sector de la acuicultura y la pesca.

		internacionales de pesca y acuicultura.	
FONDECYT Fondo Nacional de Desarrollo científico y tecnológico	Programa Público administrado por CONICYT. Creado en 1981, inaugurando la modalidad de fondos concursables introducida por el Estado Chileno como criterio para la asignación de recursos en las áreas de Educación Superior y Desarrollo Científico y Tecnológico.		MISIÓN: Su misión es estimular y promover el desarrollo de investigación científica y tecnológica básica en el país. Para ello, incentiva la iniciativa individual y de grupos de investigadores financiando proyectos de investigación de excelencia, sin distinción de disciplinas o procedencia institucional, a partir de una gestión eficiente y basada en la relación permanente y enriquecedora con sus usuarios individuales, colectivos e institucionales.
FONDEF Fondo de Fomento al Desarrollo científico y tecnológico	Creado en 1991. Organismo dependiente de la Comisión Nacional de Ciencia y Tecnología CONICYT , está inserto en el Sistema Nacional de Fondos Públicos de Fomento Tecnológico. Esto obedece a una política de desarrollo científico-tecnológico del Gobierno de Chile , como parte de una estrategia nacional de desarrollo e innovación tecnológica tendiente a lograr una fase de maduración tecnológica de la economía chilena a mediados del siglo XXI.	Propósito de fortalecer y aprovechar las capacidades científicas y tecnológicas de las Universidades e institutos tecnológicos y otros institutos, para incrementar la competitividad de las empresas, y contribuir a mejorar la calidad de vida de la población.	MISIÓN: “Contribuir al aumento de la competitividad de la economía nacional y al mejoramiento de la calidad de vida de los chilenos, promoviendo la vinculación entre instituciones de investigación y empresas en la realización de proyectos de investigación aplicada, desarrollo precompetitivo y transferencia tecnológica”
FIA Fundación para la innovación Agraria	Ministerio de Agricultura	En su rol de agencia de fomento a la innovación del Ministerio de Agricultura, centra su quehacer en promover la cultura y los procesos de innovación. Para ello apoya iniciativas, genera estrategias, transfiere información y resultados de proyectos y	MISIÓN Promover y fomentar la innovación en el sector agroalimentario y forestal, fortaleciendo las capacidades y el emprendimiento, para el desarrollo sustentable y la competitividad de Chile y sus regiones. Áreas Estratégicas ▪ Antena Tecnológica y de Cambios FIA es una antena de cambios y tendencias tecnológicas en el ámbito de la innovación que analiza información y la pone a disposición de los servicios del Ministerio

		programas innovadores.	<p>de Agricultura y de los actores del sector agroalimentario y forestal.</p> <ul style="list-style-type: none"> ▪ Iniciativas de Innovación FIA es la agencia especializada en el sector que instala capacidades, estimula, articula y cofinancia iniciativas de innovación y acompaña su gestión. ▪ Difusión y Vinculación a Redes Difusión tecnológica y articulación de productores y clientes, a través de redes, para facilitar el desarrollo de negocios. ▪ Capacitación en Innovación y Emprendimiento FIA entrega herramientas para estimular el desarrollo de las innovaciones, tales como cursos en formulación de proyectos de innovación. ▪ Impulso a la Innovación Regional FIA apoya a los gobiernos regionales en la promoción de la innovación y asignación de recursos destinados al desarrollo agrícola y forestal.
PROCHILE Dirección de Promoción de Exportaciones	Depende del Ministerio de Relaciones exteriores.		<p>MISIÓN: Tiene como principal misión la de apoyar las exportaciones nacionales, tener acceso a los mercados internacionales, diseñando alta calidad del sistema de de sistemas de información y programas especializados para aumentar la exportación de las empresas, alianzas comerciales y también apoyo a las empresas para participar en ferias internacionales y proveer regulación y información acerca de la destino de las exportaciones y las tendencias comerciales. Tiene 56 oficinas en el mundo y 15 oficinas nacionales identificadas principalmente las oportunidades de exportación y apoyo al desarrollo e implementación de comercio y promoción de estrategias de exportación.</p>

INSTITUCIONES DE FORMACIÓN E INVESTIGACIÓN

FIP Fondo de Investigación pesquera	<p>Ministerio de Economía, Fomento y Turismo, Subsecretaría de Pesca.</p> <p>El Fondo de Investigación Pesquera (FIP) fue creado por la Ley General de Pesca y Acuicultura en el año 1991</p>	<p>Está destinado a financiar estudios, necesarios para fundamentar la adopción de medidas de administración de las pesquerías y de las actividades de acuicultura. Estas medidas de administración tienen por objetivo la conservación de los recursos</p>	<p>MISIÓN: Proveer y administrar los recursos para el desarrollo de proyectos de investigación pesquera y acuícola en sus aspectos técnicos, biológicos, económicos, socioculturales y ecosistémicos, entre otros; con el propósito de poner a disposición de las autoridades, sector privado y comunidad científica, antecedentes adecuados para la administración, fijación de políticas, manejo y desarrollo sustentable de los recursos pesqueros en el país. La misión del FIP se definió en el Plan Estratégico del Consejo de Investigación Pesquera,</p>
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		hidrobiológicos, considerando tanto aspectos biológicos, pesqueros, económicos y sociales.	establecido el 8 de abril del 2002.
INTESAL: Instituto Tecnológico del Salmón	Creado en 1984 por Salmon Chile.	Privada focalizada en asistencia técnica y entrenamiento institucional.	MISIÓN: identificar los principales requerimientos tecnológicos de la industria, generar avances tecnológicos en el área de los alimentos, sanidad y control de las estándares de calidad tal como el tratamiento de residuos, la administración del sistema y certificaciones de estándares internacionales que promueven así la competitividad del clúster y actuando como una fuente de información de las políticas de mercado.
ASOCIACIÓN DE PRODUCTORES DEL SALMON Y LA TRUCHA / SalmonChile desde el 2002	Asociación privada creada en 1986 con el objetivo de representar las empresas de Salmonicultura con las instituciones Chilenas y extranjeras.	Llamado SALMON CHILE, desde el 2002, ha permitido asegurar información sectorial de los socios de las empresas (42 empresas con el 85% del total de la producción) ha permitido tener acceso a mercados internacionales y a clientes.	Define, coordina y certifica la calidad y estándares de la industria del salmón, regula propuestas de las autoridades nacionales a fin de aumentar la eficiencia de la industria a través de políticas públicas sectoriales y representan a las empresas del salmón en instancias internacionales.
Arasemar Asociación Regional de Armadores de Servicios Marítimos	Constituido el año 2002.	Asociación que reúne a los prestadores de servicios del sector marítimo (naves, empresas, empleados)	
CONICYT Comisión Nacional de Investigación Científica y Tecnológica	Dependiente del Ministerio de Educación, creada en 1967 como organismo asesor de la Presidencia en materias de desarrollo científico, la Comisión Nacional de Investigación Científica y Tecnológica - CONICYT-		<u>Objetivos o pilares estratégicos:</u> Fomento de la formación de capital humano y el fortalecimiento de la base científica y tecnológica del país. A su vez, ambos pilares son potenciados de manera transversal por un área de información científica y una de vinculación internacional.
SENCE Servicio Nacional de Capacitación y empleo	Organismo técnico del estado descentralizado, que se relaciona con el gobierno a través del Ministerio del Trabajo y Previsión Social.		MISIÓN: Contribuir a la generación de empleo, dinamizar el mercado laboral y desarrollar capital humano mediante la aplicación de políticas públicas de fomento e intermediación laboral y de capacitación orientada a la empleabilidad y la productividad.

Universidades	Universidad de Chile, Universidad Católica de Valparaíso, Universidad de Los Lagos en Puerto Montt, Universidad Austral de Valdivia y Universidad Católica de Valparaíso en la 5ta. Región, Universidad Andrés Bello en la Región Metropolitana y la Universidad Católica de Concepción, en la 8va.Región.	Las universidades ejecutan proyectos de investigación principalmente como resultado de proyectos de consultas específicas que son requeridas por las empresas privadas para profesores académicos de las universidades o son iniciativas focalizadas en generar más nuevo conocimiento, desarrollo de investigaciones aplicadas para resolver problemas específicos de la industria. Las universidades ofrecen profesionales y técnicos en el área de la administración de acuicultura, biotecnología, etc.
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Anexo 3. Interviewed Actors and Institutions

INSTITUCIONES	ENTREVISTA
INSTITUCIONES DE GOVERNANZA	
Subsecretaría de Pesca Ministerio de Economía, Fomento y Turismo Oficina Regional	Dirección Zonal de Pesca Región X de Los Lagos. Pedro Brunetti pbrunetti@subpesca.cl
SERNAPESCA Servicio Nacional de Pesca, depende Ministerio de Economía, Fomento y Turismo	Jefe Regional Área de Acuicultura Branny Montecinos
SERVICIO DE SALUD Departamento de Salud Ambiental REGIÓN DE LOS LAGOS, Subsecretaría de Salud Pública, Ministerio de Salud	Departamento de Salud Ambiental SEREMI DE SALUD Los Lagos. Gonzalo Díaz. Fiscalizador (recomendado por SEREMI)
DIRECCIÓN DEL TRABAJO Ministerio del Trabajo y Previsión Social	Directora Regional: Camila Jordan
DIRECTEMAR Dirección General del Territorio Marítimo y de Marina Mercante. Armada de Chile	Gobernación Marítima de Puerto Montt. Capitán de Navío Antonio Amigo Jimenez
SEREMI DE ECONOMÍA	SEREMI: Alex Guarda Maximowitz
SEREMI. Medio Ambiente Región de Los Lagos	SEREMI: Sibel Villalobos
Comisión Regional de uso de Borde Costero. Subsecretaría de las Fuerzas Armadas. Ministerio de Defensa.	Comisión Regional de Uso de Borde Costero. Klaus Kosiel Encargado Unidad de Borde Costero. División de Planificación Gobierno Regional.

Gobierno Regional Los Lagos	FIC: Fondo de Innovación para la Competitividad. Encargado Mauricio Figueroa
INSTITUCIONES DE FOMENTO PRODUCTIVO	
Fundación Chile	Bioteconología y Alimentos. Andres Barros abarros@fundacionchile.cl
CORFO. Ministerio de Economía, Fomento y Turismo.	Director Regional: Rodrigo Carrasco rcarrasco@corfo.cl / Sonia Barría Subdirección Programas Sectoriales e Internacionales
IFOP: Instituto de Fomento Pesquero (Corporación)	Jefe División acuicultura. Leonardo Guzman
Secretaría Regional Ministerial de Desarrollo Social. Los Lagos.	Eduardo Reyes. Encargado de capacitación y proyectos de inversión
FONDEF Fondo de Fomento al Desarrollo científico y tecnológico. Depende de CONICYT.	<u>Subdirector Programa de Acuicultura</u> : Cristian Lagos
PROCHILE Dirección de Promoción de Exportaciones. Ministerio de Relaciones Exteriores.	Director Regional: Marcelo Sobarzo.
INSTITUCIONES DE FORMACIÓN E INVESTIGACIÓN	
INTESAL: Instituto Tecnológico del Salmón. Creado por SalmonChile.	Encargado Área de Investigación: Matias Medina
ASOCIACIÓN DE PRODUCTORES DEL SALMON Y LA TRUCHA /SALMONCHILE (2002)	Gerente General Carlos Odebret
SENCE Servicio Nacional de Capacitación y empleo. Ministerio del Trabajo y Previsión Social.	Director Regional: Rodrigo Fernández. Encargado Regional Unidad Capacitación personas.
UNIVERSIDAD DE LOS LAGOS	Jefe de carreta Acuicultura y Recursos Acuáticos de la Universidad. Jose Barra
UNIVERSIDAD AUSTRAL. Instituto de Acuicultura. Sede Puerto Montt	Director: Dr. Carlos Molinet F. cmolinet@uach.cl /
UNIVERSIDAD DE CHILE	Dirige magíster y Doctorado de Acuicultura. Director de Investigación. Nelson Diaz
MUNICIPALIDAD DE PUERTO MONTT	Dirección de Desarrollo Comunitario: Subdirección de Desarrollo Económico Local: Departamento de Fomento Productivo.
MUNICIPALIDAD DE ANCUD	Unidad de Pesca Aldo Coquedano / Eduardo Cárdenas
MUNICIPALIDAD DE QUEMCHI	Dirección Fomento productivo: Carolina Barrias

Annex 4. Survey: questionnaire applied to firms

El siguiente cuestionario es parte de la investigación de tesis “*Sistemas Regionales de Innovación Basados en la Explotación de Recursos: El caso de la Salmonicultura en Chile*”, en el marco de la realización del Doctorado en Economía Regional de la Universidad de Algarve en Portugal.

Su finalidad es identificar, en base a preguntas concisas, datos relacionados con procesos de innovación, redes de trabajo, información y conocimiento en relación a la salmonicultura en la Región de los Lagos.

Todos los datos entregados son confidenciales y con fines académicos, agradecemos su valiosa colaboración.

I. Antecedentes Generales

1. ¿Cuántos trabajadores tiene su empresa?

Indicar número

Trabajadores Directos _____

Trabajadores Indirectos _____

Total de Trabajadores _____

2. ¿Qué porcentaje aproximado del total de trabajadores posee estudios superiores o técnicos?

_____ %

3. Su empresa es:

a) Nacional *Especificar región o regiones* _____

b) Extranjera *Especificar país* _____

4. ¿Cuál es el rubro en el que se desempeña su empresa?

a) Empresa productora

b) Empresa proveedora (*redes, buzos, alimentos, limpieza, etc.*)

c) Laboratorio y afines

d) Empresa piscicultora y productora de ovas

e) Planta de alimentos

II. Innovación, fuentes de conocimiento e información

1. Respecto a la innovación de productos ¿Su empresa implementó algún bien o servicio significativamente mejorado en cuanto a sus características o al uso que se destina?
 - a) Si
 - b) No

2. Respecto a la innovación de procesos ¿Su empresa implementó un nuevo o significativamente mejorado proceso de producción o de distribución?

Incluye técnicas, equipos o programas informáticos utilizados para producir bienes o servicios.

 - a) Si
 - b) No

3. Respecto a la innovación organizativa ¿Su empresa diseñó un nuevo método organizativo en las prácticas, la organización del lugar de trabajo o las relaciones exteriores de la empresa?
 - a) Si
 - b) No

4. Respecto a la innovación en el mercado ¿Su empresa ha introducido métodos de comercialización que implique cambios en el diseño, envasado, posicionamiento, promoción o tarifación?
 - a) Si
 - b) No

III. Acceso al conocimiento e información en el proceso de innovación

1. Tomando en cuenta los procesos de innovación desarrollados por su empresa ¿De qué forma accedió a estos conocimientos o fuentes informativas?
 - a) Fuentes Internas de la Empresa

Si			No	
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Dentro de la propia firma o del grupo empresarial, experiencias personales de los trabajadores, reuniones de trabajo o conversaciones con colegas.

- b) Fuentes de interacción y colaboración a partir de redes de trabajo (Networks) o capital social a nivel regional

Fuentes en instancias informales, como a partir de contactos familiares, relaciones interpersonales, informales o casuales como visitas no programadas a otras empresas. Pueden ser encuentros dentro del sector salmonícola como congresos, presentaciones, conferencias, exposiciones y/o ferias del rubro.

Si			No	
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- c) Capital Humano externo

Contratación de nuevo capital humano avanzado, empleados especialistas o consultorías senior especializadas (movilidad o circulación laboral).

Si	
----	--

No	
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d) Fuentes propias del intercambio comercial y de mercado

Relaciones comerciales con distintas empresas del rubro o de otras actividades comerciales como proveedores de equipamiento, software, laboratorios de I+D u otros proveedores de la cadena de valor como distribuidores o colaboradores. Pueden ser también nuevos proyectos empresariales colaborativos o en relación con clientes o consumidores a través de negociaciones, reclamos, necesidades o peticiones específicas.

Si	
----	--

No	
----	--

e) Fuentes institucionales y/o educacionales

Si	
----	--

No	
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Colaboración de universidades o instituciones de educación superior, proyectos de intercambio o colaboración, proyectos basados en ideas generadas en el ámbito universitario (spin-offs). Pueden ser instituciones públicas o privadas de la X Región, ONG's, proyectos colaborativos, asociaciones empresariales, instituciones nacionales o internacionales con presencia regional (Ministerios, ONG's, etc.)

IV. Análisis de redes de trabajo (Network)

1. ¿Con cuántas empresas mantiene relaciones comerciales o colaborativas?

Indicar número

2. Indique el nombre de las 3 más importantes

Nombre de la empresa, rubro y localización tomando en cuenta municipio, región y país.

Nombre	
Rubro	
Localización	
Nombre	
Rubro	
Localización	
Nombre	
Rubro	
Localización	

3. ¿Con que agentes regionales interactúa o participa regularmente? Mencione al menos 3.
Considerar instituciones regionales de gobierno, organizaciones empresariales, agencias de desarrollo regional, agencias del sector salmonícola, etc.

Nombre de la Organización	Descripción de la Actividad o Proyecto

V. Presencia regional de un Sistema Regional de Innovación

1. Qué grado de importancia le asigna a las siguientes afirmaciones:

- a) Mantener redes de trabajo y asociatividad con distintas empresas dentro del sector salmonícola regional.

Muy Importante	
Medianamente Importante	
Sin Importancia	

- b) Acceso a fuentes de información, difusión y conocimiento dentro del sector salmonícola regional

Muy Importante	
Medianamente Importante	
Sin Importancia	

- c) Alta especialización y conocimiento en el sector salmonícola por parte de las distintas empresas y organizaciones de la región.

Muy Importante	
Medianamente Importante	
Sin Importancia	

- d) El apoyo (financiero, investigación, capacitación, etc.) de instituciones públicas, privadas, centros de investigación y/o universidades.

Muy Importante	
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Medianamente Importante	
Sin Importancia	

VI. Obstáculos presentes para la innovación

- 1) Tomando en cuenta los distintos obstáculos que pueden estar presentes en la región y que impiden la realización de actividades o proyectos de innovación en su empresa, cual considera usted que es el grado de importancia de cada uno de los siguientes factores?

	Muy Importante	Medianamente Importante	Sin Importancia
Falta de financiamiento de fuentes externas			
Falta de personal calificado			
Falta de instancias donde acceder a información			
Dificultad en encontrar empresas para generar colaboración o <i>networks</i> en proyectos de innovación			
Falta de un espíritu emprendedor e innovador en la región			
Falta de confianza para iniciar proyectos colaborativos			
Falta de apoyo de las instancias regionales			
Falta de políticas de desarrollo a la salmonicultura			
Otros (especificar)			