



Ca' Foscari  
University  
of Venice

## Master's Degree programme

in Sviluppo Economico e  
dell'Impresa

Curriculum Impresa e  
Mercati Globali

Second Cycle (D.M.  
270/2004)

Final Thesis

# The Danish Innovation System

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**Academic Year**

2017 / 2018

## Contents

Introduction.....	1
1 Denmark.....	7
1.1 Economy.....	7
1.2 Demography.....	10
1.3 Politics.....	13
2 An Innovation System and its importance.....	15
2.1 The main functions of an innovation system.....	17
2.2 Players and linkages in a National Innovation System.....	18
2.3 Innovation system dimensions.....	20
3 The Danish Innovation System.....	23
3.1 The origins of the Danish Innovation System.....	24
3.2 The National Innovation System in Denmark.....	25
3.2.1.1 Innovation organisations and their recent development.....	32
3.2.1.2 The Danish Innovation Centres (ICDKs).....	46
3.2.1.3 European Union policies and Denmark.....	48
3.3 The Regional Innovation System in Denmark.....	49
3.3.1 The Regional policy.....	56
3.3.1.1 The Regional Growth Forums.....	60
3.3.1.2 Invest in Odense, a task force in the municipality: a practical case from Southern Denmark.....	62
4 Research and higher education funding system.....	67
4.1 Public and Private Expenditure on R&D.....	67
4.1.1 Public R%D funds.....	69
4.1.2 Private R&D expenditure.....	71
4.2 Main Characteristics of the Research Funding System.....	71
4.2.1 The first tier.....	72
4.2.2 The second tier.....	72
4.2.2.1 The second-tier structure.....	73
4.3 Research Institutions in Denmark.....	74
4.3.1 Universities.....	74
4.3.1.1 Funding System.....	76
4.3.1.2 An innovation unit inside the Southern Denmark University (SDU): a practical case from Odense.....	81
4.3.1.3 The incubator Cortex Lab.....	91
4.3.2 Government research institutions.....	97

4.3.3	Private enterprises and research labs .....	98
5	Lifelong learning and the Danish Labour Market.....	101
5.1	Lifelong learning.....	101
5.2	The Danish Labour Market and Employment Policy .....	112
5.2.1	Active Labour Market policies (ALMP) .....	113
5.2.2	The unemployment benefit system .....	116
5.2.3	The Job Centres .....	117
5.2.4	The role of social partners.....	118
5.2.5	The flexicurity Model .....	119
	Conclusion .....	129
	Annex A: Definitions of indicators of the European Innovation Scoreboard.....	133
	References .....	135

## Figures

Figure 1.1:Denmark's GDP at market prices (million Euro) - (2008-2017). .....	7
Figure 1.2: GDP Annual Growth Rate (2008-2017) .....	8
Figure 1.3: GDP per capita (Euro) – (2008-2017) .....	8
Figure 1.4:Percentage of GDP from three economic sectors in 2017.....	9
Figure 1.5: Industry (including construction and manufacturing, value added (% of GDP)) .....	9
Figure 1.6: Services, value added (% of GDP).....	10
Figure 1.7: Agriculture, forestry, and fishing, value added (% of GDP) .....	10
Figure 1.8: Denmark's population.....	11
Figure 1.9: Population growth (annual %) .....	11
Figure 1.10: Employment in industry (% of total employment) (modelled ILO estimate).....	12
Figure 1.11: Employment in services (% of total employment) (modelled ILO estimate) .....	12
Figure 1.12: Employment in agriculture (% of total employment) (modelled ILO estimate) .....	13
Figure 2.1: Definitions of National Innovation System from recent literature .....	15
Figure 2.2: Actors and linkages in the innovation system.....	20
Figure 3.1: Aspects of the concept of Innovation .....	23
Figure 3.2: Performance of EU Member States Innovation Systems.....	25
Figure 3.3: Danish performance and growth per dimension. ....	27
Figure 3.4: Innovative companies in Denmark by type of innovation .....	28
Figure 3.5: Higher educate (tertiary education) employees in the companies (Share of companies with highly educated employees in percent). ....	29
Figure 3.6: Cooperation between companies and knowledge institutes. ....	30
Figure 3.7: Gross Domestic Expenditure on Research and Development (GERD) - Million 2000 dollars, constant prices and PPP. ....	30
Figure 3.8: Barriers to R&D and innovation - before and during the financial crisis .....	31
Figure 3.9: Danish Research and Innovation system. ....	36
Figure 3.10: The Research and Innovation council system.....	38
Figure 3.11: Structure of Danish national Research and Innovation System.....	40
Figure 3.12: Innovation Fund Denmark. ....	42
Figure 3.13: The previous strategy.....	43
Figure 3.14: The new strategy.....	43
Figure 3.15: Innovation Fund Denmark and its contribution on the productivity.....	44
Figure 3.16: The governance structure. ....	45
Figure 3.17: Regional disparities in GDP per capita in 25 OECD nations. ....	49

Figure 3.18: A regional growth model.....	53
Figure 3.19: Relationships on the Innovation Triangle. ....	54
Figure 3.20: The innovative space: players and linkages. ....	55
Figure 3.21: From innovation to growth. ....	60
Figure 3.22: Structure of Danish Growth Organisations. ....	61
Figure 3.24: Quadruple Helix .....	66
Figure 4.1: R&D Expenditure in percent of GDP (1993-2003).....	67
Figure 4.2: Private and Public R&D expenditure in percent of GDP (1997-2015).....	68
Figure 4.3: Public Expenditure on R&D distributed on Financial Source, 2003. ....	69
Figure 4.4: Sectoral Distribution of R&D grants from the Financial Act, 2003. ....	70
Figure 4.5: Distribution of Financial Act Grants for Basic Research according to Scientific Area, 2003.....	71
Figure 4.6: Second tier system. ....	74
Figure 4.7: Relative R&D Expenditure distribution between the ten largest Danish Universities, 2003.....	78
Figure 4.8: R&D FTE at Danish Universities and Institutions of Higher Education, 2003.....	79
Figure 4.9 R&D FTE at Institutions of Higher Education, 2003. ....	80
Figure 4.10: Bachelor and Master Students enrolled at Danish Universities, 2003. ....	81
Figure 4.11: RIO's structure.....	82
Figure 4.12: Vision, Target groups and objectives. ....	83
Figure 4.13: RIO's internal teams. ....	84
Figure 4.14: Guided students are affiliated with the following campus.....	85
Figure 4.15: Career Guidance distribution based on educational level.....	86
Figure 4.16: Career Guidance distribution based on faculty. ....	86
Figure 4.17: Employability arrangements for all students at SDU in 2017. ....	87
Figure 4.18: Events and participants based on faculty. ....	88
Figure 4.19: Inventions, IP Commercialisation Agreement and Spinouts.....	89
Figure 4.20: Entrepreneurship Lab's statistics. ....	92
Figure 4.21: Startups and number of participants based on faculty.....	94
Figure 4.22: Co-operation distributed by faculty.....	95
Figure 4.23: External visitors in the incubation environment. ....	96
Figure 4.24: R&D FTE at Government Research Institutions according to Scientific Area, 2003. ....	97
Figure 4.25: Private Funding agencies in Denmark for research, innovation and tertiary education. ....	98

Figure 5.1: The Danish Education System. ....	105
Figure 5.2: Adult Education System. ....	109
Figure 5.3: Job mobility in 2005. ....	113
Figure 5.4: The Danish flexicurity model.....	119
Figure 5.5: The overall strictness of EPL in 2003.....	121
Figure 5.6: Participation in adult education and continuing education and training. ....	124
Figure 5.7: Flexibility in setting wages. ....	124
Figure 5.8: Job security.....	126
Figure 5.9: Job satisfaction.....	126
Figure 5.10: Degree of coverage of unemployment. ....	128

## Tables

Table 3.1: Indicators of Innovation Index 2015. ....	26
Table 3.2: Danish clusters of competence, 2001. ....	33
Table 3.3: Interaction index: benchmarking of the current interaction between knowledge institutions and the business and industry sector in 21 OECD countries. ....	34
Table 3.4: R&D expenditure in Denmark (1991-2005) (percent of GDP).....	36
Table 3.5: The Danish Innovation Centres .....	46
Table 3.6: Number of Commercial Clients in 2014. ....	48
Table 3.7: GDP per capita in the cities relative to surrounding areas (1995-2000).....	50
Table 3.8: Identified industrial resource areas. ....	51
Table 3.9: Average personal income in the marginal areas (2000-2002)- (1000 DKK). ....	51
Table 3.10: Average income growth rate in the nation and marginal areas (2000-2002).....	52
Table 3.11: Functions and units in the danish system of innovation.....	58
Table 3.12: Selected Growth and Innovation Initiatives since 2003.....	59
Table 4.1: Danish Universities 2004/2005. ....	75
Table 4.2: R&D Expenditures for HEs in 2004, in million DKK.....	77
Table 5.1: Labour market participation 2005 – 2017 (% of the total workforce) .....	112
Table 5.2: Public expenditure and participant stocks on LMP (% of the GDP). ....	114
Table 5.3: Indexes on the employment regulation - the ten most flexible EU - countries, incl. Norway (Index).....	120
Table 5.4: Indicators of the strictness of employment protection for regular employment 2003. Index 0-6.....	122

## Acronyms

AT	Austria
BE	Belgium
BG	Bulgaria
CH	Switzerland
CY	Cyprus
CZ	Czech Republic
DASTI	Danish Agency for Science, Technology and Innovation
DE	Germany
DK	Denmark
DKK	Danish Krone (currency)
DNRF	Danish National Research Foundation
EE	Estonia
EL	Greece
ERA	European Research Area
ES	Spain
EU	EU
EU	European Union
FI	Finland
FR	France
FTE	Full Time Employees
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on Research & Development
GTS	Authorised Technological Service
HR	Croatia
HU	Hungary
ICDK	Danish Innovation Centres
ICT	Information and Communication Technology
IE	Ireland
IFD	Innovation Fund Denmark
ILO	International Labour Organisation
IT	Italy
LT	Lithuania
LU	Luxembourg
LV	Latvia
MOSTI	Ministry of Science, Technology and Innovation
MT	Malta
NL	Netherlands
NO	Norway
OECD	Organisation for Economic Co-operation and Development
PCT	Patent Cooperation Treaty
PL	Poland
PT	Portugal
R&D	Research and Development

RIO	Research Innovation Organisation
RO	Romania
SDP	social democratic party
SDU	Southern Denmark University
SE	Sweden
SI	Slovenia
SK	Slovakia
SME	Small and Medium Enterprises
UK	United Kingdom

## Introduction

Denmark is the smallest state of the Scandinavian area and it is part of European Union since the first January of 1973. Despite its dimension, it has an advanced economy, and during the recent years, it is become an innovation leader among the European countries as defined by Innovation Scoreboard edited by the European Commission. Moreover, today Denmark is considered as one of the strongest knowledge society in Europe.

The work aims to analyse the Danish innovation system to understand his structure, the role of the main players such as firms, universities and institutions with a specific focus on their relationships. Some specific entities, working in Odense, will be analysed through the interviews done during the mobility in Denmark.

At these aims, this thesis is articulated in five sections.

The first is dedicated to the description of the main characteristics of Denmark such as population, economy and politics in order to understand the context of the analysis.

It has a population of just 5.7 million, the services constitute the main economic sector where the most part of workers is employed. The industry is just a marginal sector.

From a political point of view, Denmark is governed by the social democratic party, but as other European countries, the extreme right party is increasing his political participation influencing the economic and social policies of the government.

The second part starts from a focus on literature in order to understand better what an innovation system is, and which are the main elements and players to be analysed in order to provide a complete and coherent study.

The innovation system concept discussion has started many decades ago, but it is still object of study with Lundvall and Nelson. At the end of the eighties, Freeman gave an important and complete definition: *“The network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies”* (Freeman, 1987)

As it will be shown, a national innovation system is responsible of five main functions: the creation of new knowledge, the research, the resources management, the implementation of positive external economies in the form of an exchange among the various players and the formation of new markets and businesses.

The third section focuses on the Danish innovation system, trying to map all the institutions involved at the national and at the regional level. Several national and regional agencies and councils were been identified. Anyway, it is continuously modified and improved in order to obtain a better use of resources.

It will be analysed the enterprise environment to identify how many firms innovate, what kind of barriers they have to overcome and also the percentage of high qualified employees to understand the importance of knowledge and high qualifications inside the companies. Moreover, it is measured the cooperation between companies and knowledge institutes, and the business and industry sector because the system is entirely based on public and private organisations, and the interaction between them become crucial to enhance the actions and the objectives of the institutions, universities and companies.

A particular focus will be on Innovation Fund Denmark and Danish Innovation Centres (ICDKs).

Innovation Fund Denmark, established in 2014, is the new institution about innovation and it is the result of the merger strategy of three existing bodies to have a more effective institution. In 2015, it supported its activities with 213 million of Euro.

The creation of a unique organisation gave the possibility to obtain a multisided institution with a wider view on various aspects such as investments, education and innovation.

Innovation Fund Denmark has some core research areas in its strategy such as bioresources food lifestyle, energy and environment, production and materials, infrastructure and construction and health.

The Danish Innovation Centres are offices abroad which offer R&D support to the Danish Small and Medium Enterprises. Moreover, they are responsible for the internationalisation of research and education institutions.

There are seven Innovation Centres and they are located in Palo Alto, Shanghai, Munich, San Paulo, Seoul, New Delhi/Bangalore and Tel Aviv.

At the regional level, the focus will be on the Regional Growth Forums and the practical case form the city of Odense based on the interview.

In 2007, the Regional Growth Forums were been established in all the five Danish regions. They are responsible for the creation and the maintenance of growth in regions

through the implementation of three functions: develop the regional strategy, monitor the regional economy and provide recommendations on regional activities.

Invest in Odense is a public organisation and it was created at the end of 2013 by the Municipality of Odense as a task force to bring the growth on new businesses after the crisis of the local industrial sector for important companies such as the Maersk that closed the shipyard in 2012.

It aims to create new jobs in order to reduce unemployment in the city, attract companies to invest within the potential areas, attract venture capitalists and help companies to set a business in the city. It collaborates with firms and universities in particular with the local Southern Denmark University.

They have developed various strategic sectors such as Robotics, Drones, Health Tech and Tourism thanks to the collaboration with the other strategic players. For example, for the Robotics they are collaborating with Robotics Cluster of Odense, for the drones with the University who has implemented the first European master in drones, and with the airport that has become the national tester for this kind of technology. The university hospital is the main partner for the health tech sector. Moreover, the collaboration is also at an international level where they have relationships with Japan to test medical product in Danish hospitals.

They play a fundamental role on attracting investments in the city, within those specific areas, but with positive effects on the entire local economy.

The fourth part is dedicated to the research and higher education funding system, the private and public expenditure, the characteristics of the funding system and the main institutions involved.

At the beginning, the total expenditure in research is analysed with a focus on what financed through public funds and what provided by private sources. In Denmark, private organisations play an important role in research financing. Moreover, the main scientific areas of research and object of investments are identified.

Denmark has a two-tier system. The first tier provides basic research as a lump sum without any constraint of use for the beneficiaries. The second tier includes resources allocation from institutions and private players such as firms and foundations.

It can be identified various research institutions: universities and other higher education entities, government research institutions controlled by different ministries and private companies.

There are five multi faculties universities, two technical faculty universities and the Business School of Copenhagen. They were reduced to optimise resources, to strengthen education and research and improve their competitiveness on the international perspective. The Copenhagen University is responsible for the 28% of the total expenditure on R&D.

Then, two practical cases from the Southern Denmark University of Odense are analysed in detail thanks to the interviews granted by two employees of the Research Innovation Organisation and SDU Cortex Lab.

The Research Innovation Organisation is an innovation unit inside the university and it embodies the crucial role of the education institution on boosting innovation in society and in firms. It was created in 2017 as result of an independent decision of the University, but pushed by political pressure on innovation from the central government. It is independent, but it has a cross role on each faculty allowing to be fully involved in all scientific areas.

The unit tries to build bridges with the business community, ensure students employability, increase the number of companies originating from SDU, win research and innovation funds and promote projects to strengthen SDUs interests.

It is composed by eight teams, each one with a specific function. One of this team is the incubator Cortex Lab, now called Entrepreneurship Lab, opened in 2016 in the city of Odense. Given its importance, today it is active in all five campuses of Southern Denmark University.

It has developed various programs to try to help out students who want to create a business beside their studies. It offers different types of support, but it mainly helps to develop the ideas, to find investors and give them an office space.

The last part is dedicated to the Lifelong Strategy, the Danish Labour Market and the Flexicurity Model.

The first relates to the strategy and policies implemented by the government to build a knowledge society and a world class education system. It recognized the great importance of the education system and the continuing training for adults. This allows

to have workers with updated skills, able to bring new competencies and capabilities inside the workplace. The dynamic and active environment, created by these flows of new knowledge, helps to increase the competitiveness of companies and bring innovation inside the firms so, it facilitates the creation of growth and prosperity in the country.

The Danish labour market, the core element of the Danish welfare system, is the result of the combination of various elements such as the active labour market policies, the unemployment benefit system, the dynamic role of job centres and social partners and the lifelong education strategy introduced before. All these elements have led to the implementation of what is called the Flexicurity Model. It is the result of the combination of two main principles: the flexibility of the labour market for the employers and the security for the employees through the active labour policies.

The model is sustained by a high interaction between the parties and a strong participation of social partners.

This model allowed to Denmark to keep the employment rate high and reduce unemployment. Of course, it is not just the flexicurity to be responsible for these results, but also the lifelong strategy that allows the workers to be always competitive during the life through the continuing training and adult education programs.

These two factors seem to be marginal, but they have a strong impact on the Danish system because they allow to be competitive and create a knowledge flow in the business environment with positive effects on innovation.



# 1 Denmark

Denmark is one of the smallest countries among the OECD members with a limited population if compared to other European regions, and one of the countries with the highest production costs. Despite this particular context, Denmark has a strong and advanced economy.

Today Denmark is regarded as one of the strongest knowledge society in Europe, it continues to lead the ranking and the government is constantly involved in a continuous process of improvement. (Park & Lee, 2005)

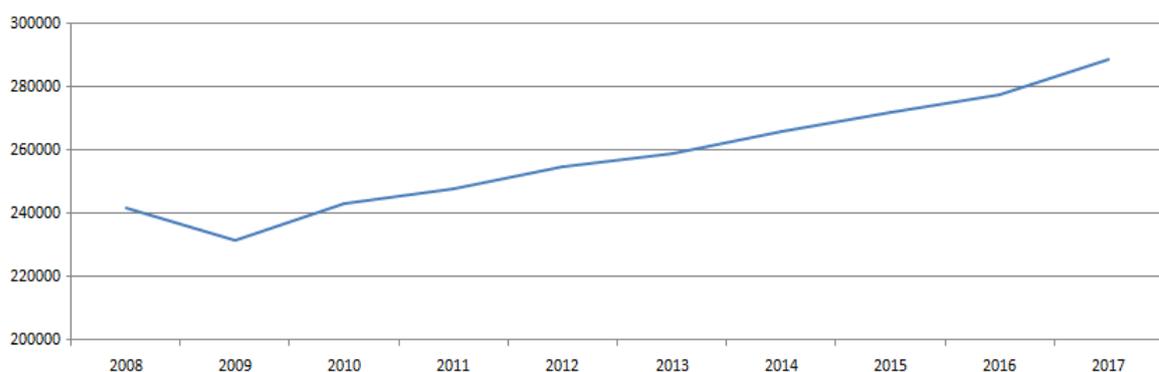
In the following paragraphs is presented a short presentation of Denmark through the analysis of the main economic, social and political characteristics.

## 1.1 Economy

It follows a short overview of Denmark's economy in order to understand better in which context the innovation system analysis takes place.

In 2017, Denmark had a GDP (Gross Domestic Product) of 288,980.9 million (Figure 1.1). In 2009, it can be identified a drop caused by the financial crisis. (European Commission, 2018b)

Figure 1.1: Denmark's GDP at market prices (million Euro) - (2008-2017).

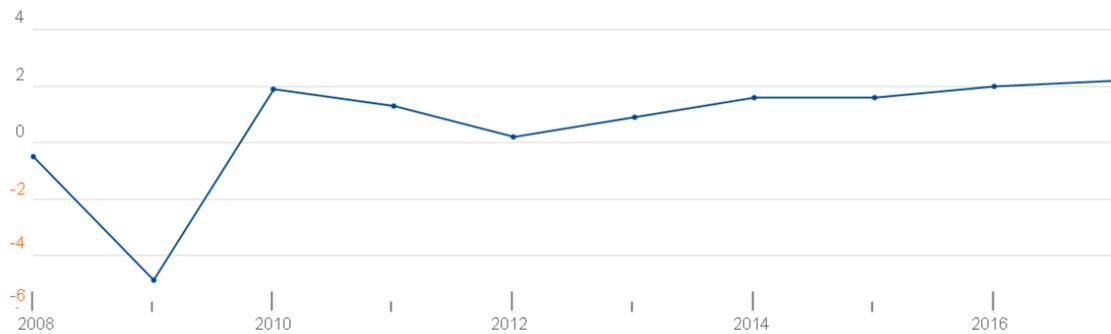


SOURCE: AUTHOR'S ELABORATION FROM EUROSTAT (EUROPEAN COMMISSION, 2018B).

As it is possible to see with the following graph (Figure 1.2), Denmark had a growth rate of 2% in 2016. Except for 2008-2009, it had a positive growth with a rate between 1-2%

during the last 10 years. In 2008, Denmark reached the GDP peak then, the growth dropped and the GDP decreased with a rate of -4.9% in 2009. (World Bank, 2018)

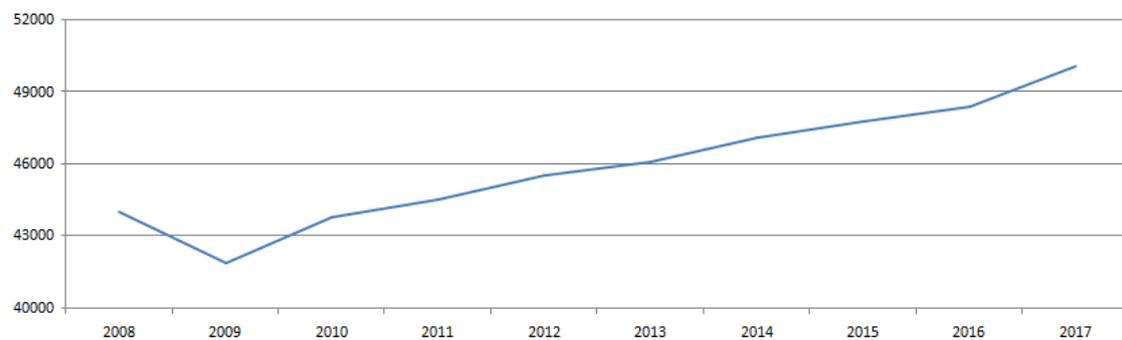
Figure 1.2: GDP Annual Growth Rate (2008-2017)



SOURCE: (WORLD BANK, 2018)

The GDP per capita is increasing with exceptions due to the world economic downturns. In 2017 it was 50,100.00 € (Figure 1.3). (European Commission, 2018b)

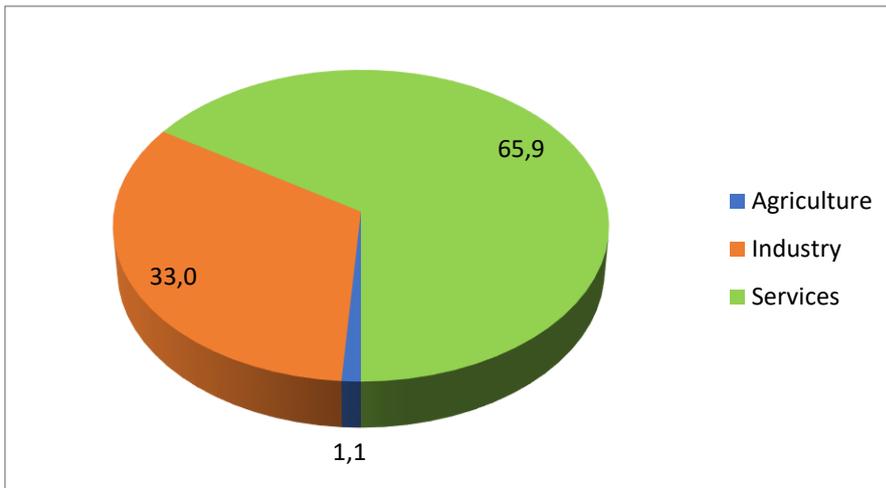
Figure 1.3: GDP per capita (Euro) – (2008-2017)



SOURCE: (EUROPEAN COMMISSION, 2018B)

In 2017, Services contributed for 65.9 % of the total country's GDP, confirming to be a key sector for Denmark along the Industry one that accounted for the 33.0 % according to the World Bank (Figure 1.4). (World Bank, 2018)

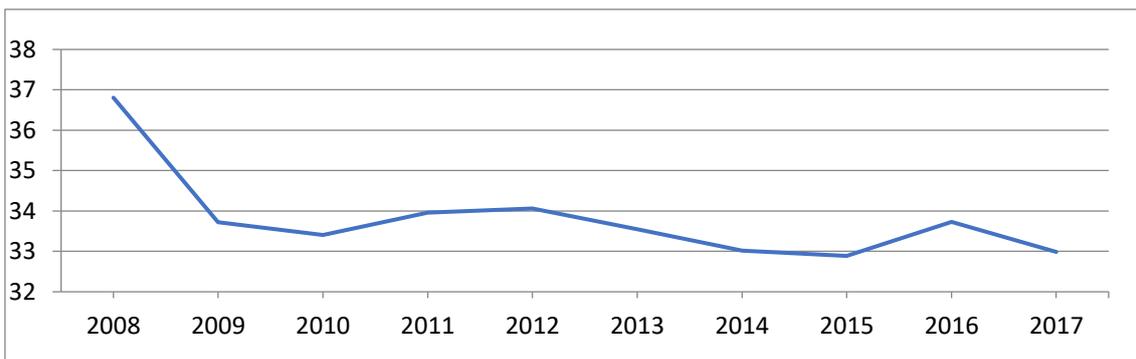
Figure 1.4: Percentage of GDP from three economic sectors in 2017.



SOURCE: AUTHOR'S ELABORATION FROM WORLD BANK DATA (WORLD BANK, 2018)

Looking the Figure 1.5, it can be observed as in 2008-2009, the GDP from the industry and manufacturing sector decreased by three percentage points and that one from Services, that was at 72.7%, increased reaching 65.9% in 2009. Anyway, the economic balance among sector looks like constant without any strong economic shock. (World Bank, 2018)

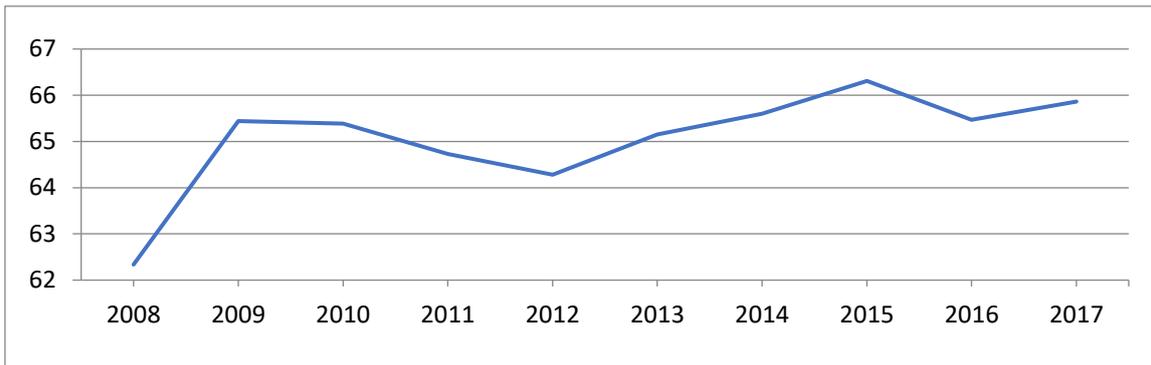
Figure 1.5: Industry (including construction and manufacturing, value added (% of GDP))



SOURCE: AUTHOR'S ELABORATION FROM WORLD BANK DATA (WORLD BANK, 2018)

Services play a key role in Danish economy with a constant contribution on the national GDP during the last ten years (Figure 1.6). (World Bank, 2018)

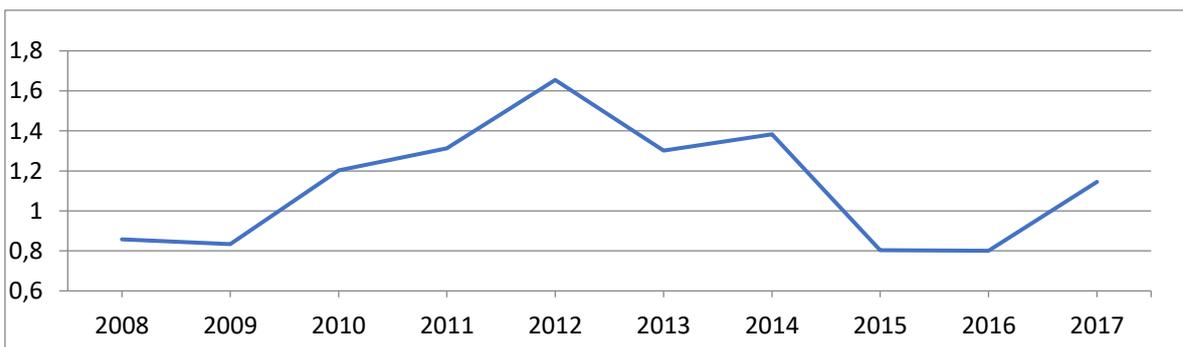
Figure 1.6: Services, value added (% of GDP)



SOURCE: AUTHOR'S ELABORATION FROM WORLD BANK DATA (WORLD BANK, 2018)

As Figure 1.7 shows, the agriculture represents just a small part of the GDP in fact, it counts more or less of 1% of the total economy. (World Bank, 2018)

Figure 1.7: Agriculture, forestry, and fishing, value added (% of GDP)



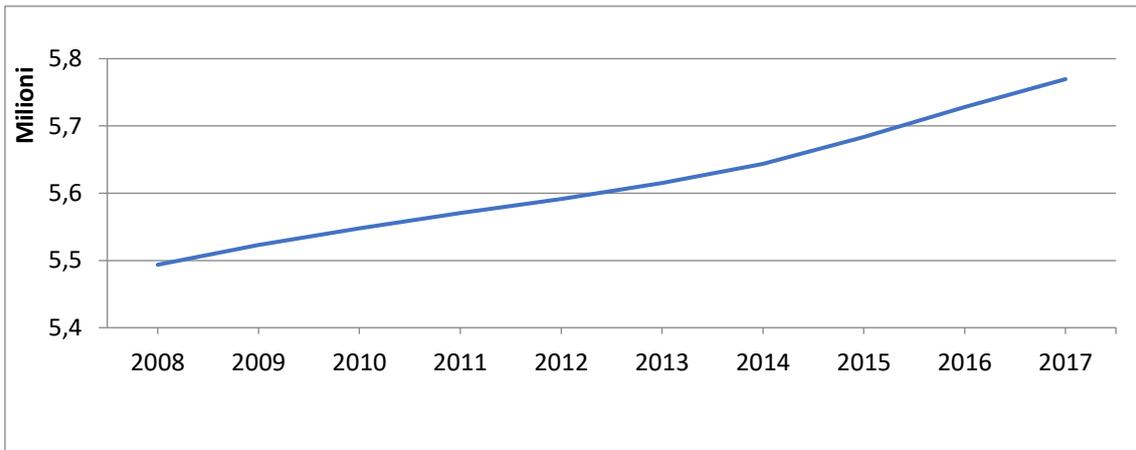
SOURCE: AUTHOR'S ELABORATION FROM WORLD BANK DATA (WORLD BANK, 2018)

## 1.2 Demography

Today, the population is about 5.7 million and it is slowly increasing with an annual rate of 0.75% (Figure 1.8, Figure 1.9). (World Bank, 2018)

It must be considered that during the last years, there was a strong immigration, as consequence of the immigration flux, that has modified the population composition of Denmark and has influenced the habitant growth rate.

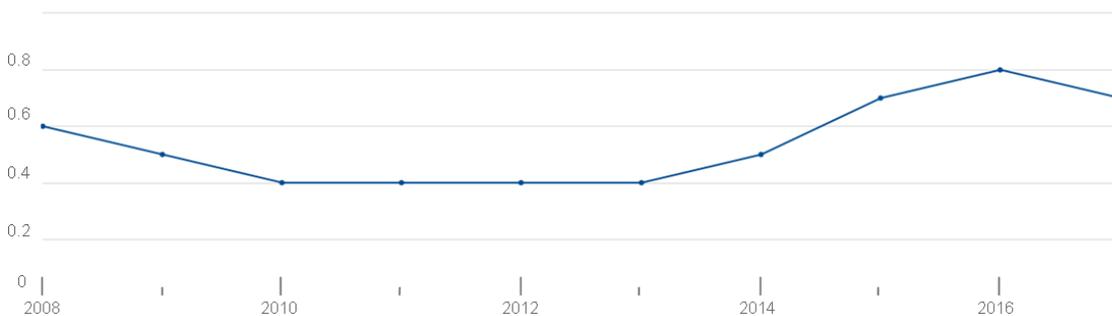
Figure 1.8: Denmark's population



SOURCE: AUTHOR'S ELABORATION FROM WORLD BANK DATA (WORLD BANK, 2018)

It can be noticed how the financial crisis affected the population growth, probably due to the uncertainty of the future. It was constant during the downturn, but since 2014 it has started to grow again.

Figure 1.9: Population growth (annual %)

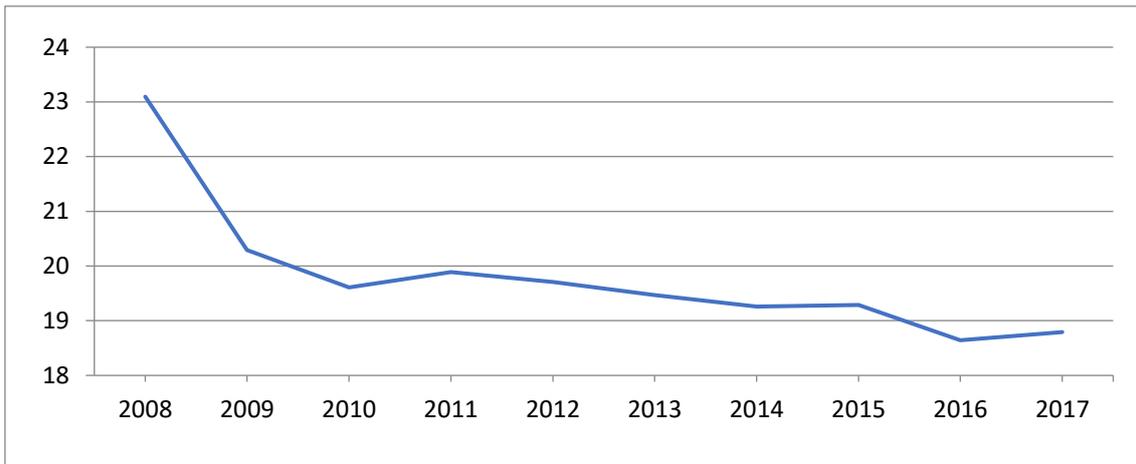


SOURCE: (WORLD BANK, 2018)

The Industry sector has suffered a lot the crisis and various plants were transferred to countries with lower costs of production. An example can be the Maersk, one of the biggest companies for ship construction that, in 2012, closed the shipyard in Odense, responsible for 6000 jobs.

The graph below (Figure 1.10) shows perfectly this trend; in 2009, the employment in industry has started to decrease. Anyway, it is still an important sector with the 15-20% of employment (Figure 1.10). (World Bank, 2018)

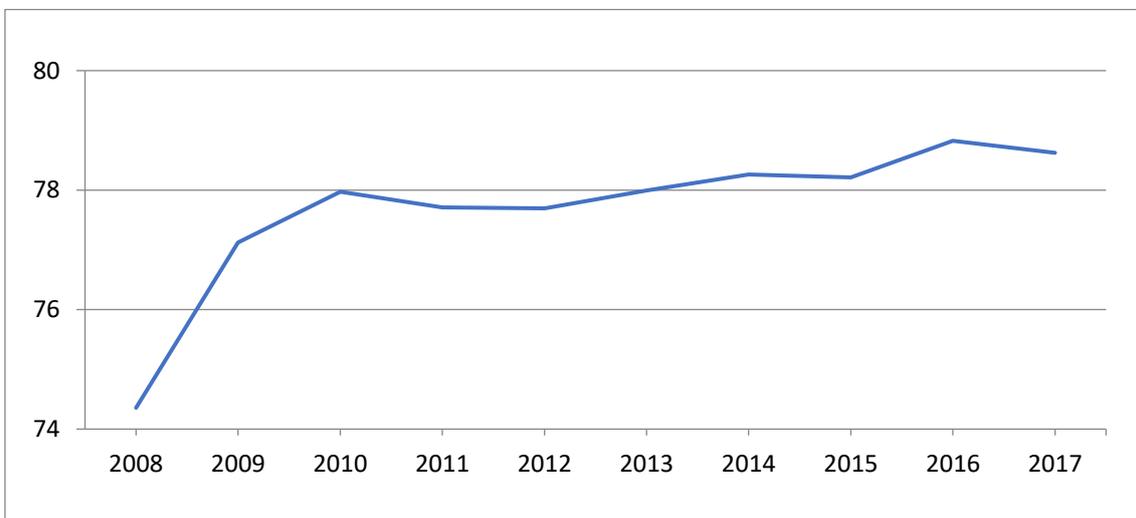
Figure 1.10: Employment in industry (% of total employment) (modelled ILO estimate)



SOURCE: AUTHOR'S ELABORATION FROM WORLD BANK DATA (WORLD BANK, 2018)

It is the service sector that employs the large part of population with a value close to 75% confirming to be important for the GDP, but also for the population employability (Figure 1.11). (World Bank, 2018)

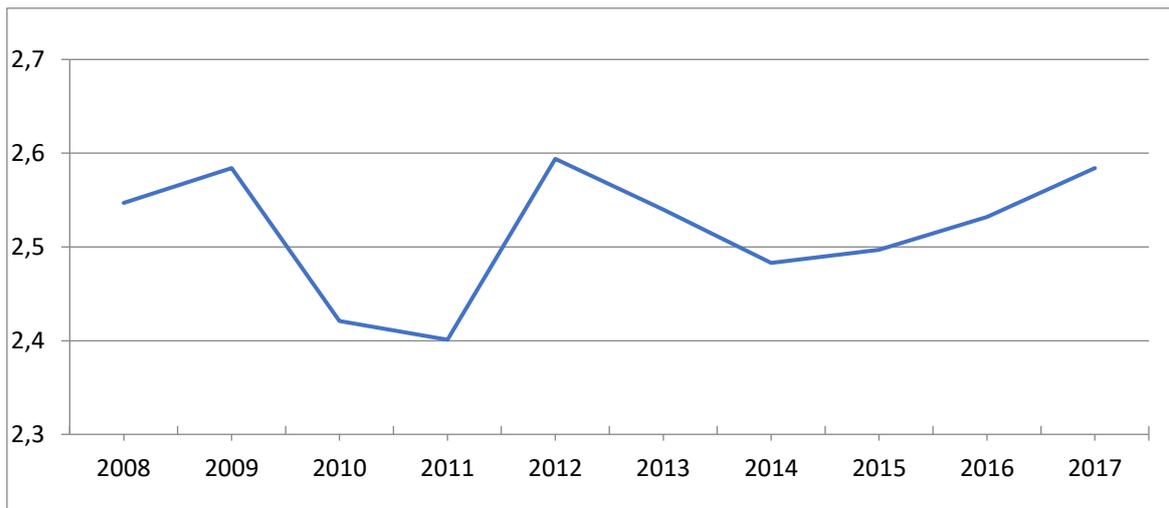
Figure 1.11: Employment in services (% of total employment) (modelled ILO estimate)



SOURCE: AUTHOR'S ELABORATION FROM WORLD BANK DATA (WORLD BANK, 2018)

In correlation to the GDP's contribution, the agriculture contributes for the 2.5% of the national employment confirming to be a marginal economy sector for Denmark (Figure 1.12). (World Bank, 2018)

Figure 1.12: Employment in agriculture (% of total employment) (modelled ILO estimate)



SOURCE: AUTHOR'S ELABORATION FROM WORLD BANK DATA (WORLD BANK, 2018)

### 1.3 Politics

Denmark, officially Kingdom of Denmark, is a democratic parliamentary constitutional monarchy. The political chief is the Queen, but the executive power is held by the Prime Minister.

The political system is defined as a multi-party structure, where various parties can enter in the Parliament at the same time. So, as it will be shown, many times the governments are characterised by minority administrations.

Since 1909, there was not a party who has had the majority inside the Parliament so, coalitions were formed by most influential parties. (GlobalSecurity.org, 2018)

Recently, because of the growing immigrants and refugees during the last two decades, and unsuccessful integration policies that did not work, it is grown populist anti-immigrant sentiment through the population. This has led to the emergence of the right parties such as Danish People's Party and, as consequence, several revisions of the immigration laws.

The Social Democratic Party, born with a close relationship with the labour movement, today it represents the middle class and it held the power for a decade from 1982 to 1993. Afterwards, the party led minority coalitions to form a government. And with the high immigration also the Danish People's Party, doubling its numbers of parliamentary seats, entered in the coalition created by the Liberal Party in 2001.

In 2009 another coalition was created between the Liberal Party and the Konservative with the parliamentary support of the Danish People's Party. The government has various key issues in the political agenda such as the social welfare system, taxes and immigration. (GlobalSecurity.org, 2018)

In 2011, the left Social Democratic Party with Helle Thorning-Schmidt created the government with Social Liberal Party. They had similar views and opinions on the main contents of the agenda such as economy, welfare and immigration, but they didn't agree about taxes. The Social Democratic Party wanted to raise taxes on wealth and banks in order to avoid the austerity measures. Instead the opposite policy was supported by the Social Liberal Party.

In 2016, the Social Liberal Party lost the majority and has created a minority government with a tripartite coalition with the Liberal Alliance and the Conservatives. The coalition agreed to cut tax on wealthy and increase the defence spending. (GlobalSecurity.org, 2018)

This is a short overview about the politics in Denmark during the last two decades and, as seen, there is not a party with a strong majority, but the various parties almost agree on the program and this give the opportunity to have a clear strategy and make effective policies.

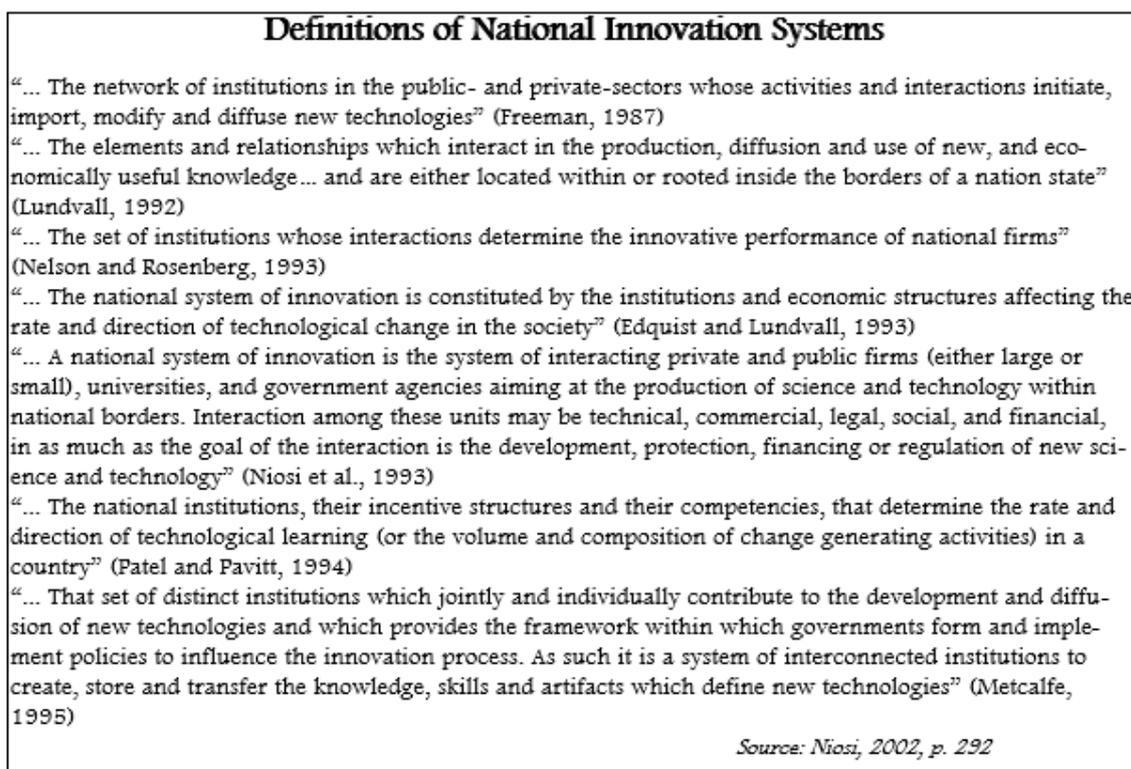
## 2 An Innovation System and its importance

Innovation theories have been developed during last decades, moving their focus on the individual entrepreneur or firm, the environment where the company operates and on institutions, government and universities.

In this context, the concept of Innovation System has started to be discussed during the eighties with Freeman and taken up again by Lundvall and Nelson (Figure 2.1).

In 1987, Freeman has defined an innovation system as *“The network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies”* (Freeman, 1987).

Figure 2.1: Definitions of National Innovation System from recent literature



SOURCE: (FEINSON, 2003)

In 1997, a broad definition was given by Edquist in his book *Systems of Innovation: Technologies, Institutions and Organisations*. Edquist defined a system of innovation as *“all important economic, social, organisational and other factors that influence the development, diffusion and use of innovations”* (Edquist, 2005).

So, the innovation system refers to the factor that determine the innovations and not the effects such as economic growth, employment, etc..

The innovation system approach has become more important because of three factors (OECD, 1997):

- the use of systems approaches;
- the economic and social importance of knowledge;
- the number of institutions involved in knowledge.

The systemic approaches were been developed to study the technology development opposed to the linear models. Innovation is generated from different sources and during all the stages.

Nowadays, the economic activities are more and more knowledge intensive as it is possible to see in the modern high-tech industries and the correlated demand for high qualified workers. So, the focus is increasingly on the flows of information responsible to improve the performance in *knowledge-based economies* where the production, distribution and use of knowledge represent the most important factors.

Innovation is not seen such as a simple stage, but it is a process and it becomes the result of complex interaction between various actors and institutions. As consequence, an innovative firm becomes an actor capable to operate in a network, collaborate with different institutions and firms, build linkages with customers and suppliers, and establish a productive relationship with them.

In 2000, Bengt Ake Lundvall defined the innovation as *"a ubiquitous phenomenon in the modern economy. In practically all parts of the economy, and at all times, we expect to find on-going processes of learning, searching and exploring, which result in new products, new techniques, new forms of organization and new markets"* (Edquist & McKelvey, 2000).

The economist Lundvall considers the innovation systems both social and dynamic (Edquist & McKelvey, 2000). This because of the double nature of institutions who develop the entire system and build the linkages to connect different players. It relies on institutions constituted and regulated by laws, social and cultural norms and other standards. Moreover, it is considered dynamic for the financial flows between the various and heterogenous players inside the system.

## 2.1 The main functions of an innovation system

The innovation system concept is not yet well defined as it is easily understood by the various and heterogeneous definitions given before. The same is for its functions and, even if many researchers have tried to identify them, it does not exist a clear and unique description of them.

Anyway, in 2000, Johnson and Jacobsson identified five main functions of an innovation system (Feinson, 2003):

- Create 'new' knowledge;
- Guide the direction of the search process;
- Supply resources, i.e. capital and competence;
- Facilitate the creation of positive external economies (in the form of an exchange of information, knowledge, and visions);
- Facilitate the formation of markets.

Others, such as Liu and White, identified five primary activities (Feinson, 2003):

- research (basic, developmental, engineering);
- implementation (manufacturing);
- end-use (customers of the product or process outputs);
- linkage (bringing together complementary knowledge);
- education.

Rickne, discussing which functions each player is giving to the new technology-based firms, provided an expanded list (Edquist, 2001):

1. to create human capital
2. to create and diffuse technological opportunities;
3. to create and diffuse products;
4. to incubate in order to provide facilities, equipment and administrative support;
5. to facilitate regulation for technologies, materials and products that may enlarge the market and enhance market access;
6. to legitimise technology and firms;
7. to create markets and diffuse market knowledge;
8. to enhance networking;
9. to direct technology, market and partner research;

10. to facilitate financing;
11. to create a labour market that the NTBF can utilise.

The various activities must not be expected to be independent of each other, they are correlated, and they reinforce each other. To get a satisfying final result, the various activities and functions must be coordinated, and a strong relationship must be built among them in order to obtain a productive collaboration. This is, of course, one of most difficult challenge to win.

This is confirmed by the statistics that revealed that the innovations are developed in collaboration between firms and other organisations.

## 2.2 Players and linkages in a National Innovation System

Another important characteristic is the set of actors and linkages that allows the innovation system to work properly.

The researchers made distinction between narrow Innovation system concept and the broad perspective. The first one includes all the institutions and policies that are directly involved in innovation from the scientific and technological point of view. The broad perspective considers also the social, political and cultural environment of that specific country.

So, the narrow version represents just an integrated system of economic and institutional agents responsible to promote the creation, diffusion and use of innovation inside the economy.

In 1999, the Organisation for Economic Cooperation and Development (OECD), considering the narrow concept, has identified five main players:

- Governments
- Bridging institutions
- Private enterprises
- Universities
- Other public and private organisations

The government is not just the national one, but regional, local and also international if, for example, we look at the European Union. The government is responsible to set the strategies and policies.

Bridging institutions are the intermediaries between the researchers and the government and they could be identified with the research councils and research associations.

Private enterprises are composed by firms and research organisations financed with private funds.

Universities constitute one of the most important players nowadays. They provide and disseminate knowledge and develop new skills.

Other private and public organisations that have the role to support the other players. (Feinson, 2003)

The relations between the different actors are fundamental for innovation and for the activities of the innovation system. The institutions are influenced by organisations, it could be said that they are integrated with them. The same is valid for organisations that are influenced by institutional environment and rules, they are shaped depending on the environment where they operate. These relations are very complex and interconnected. (Edquist, 2001)

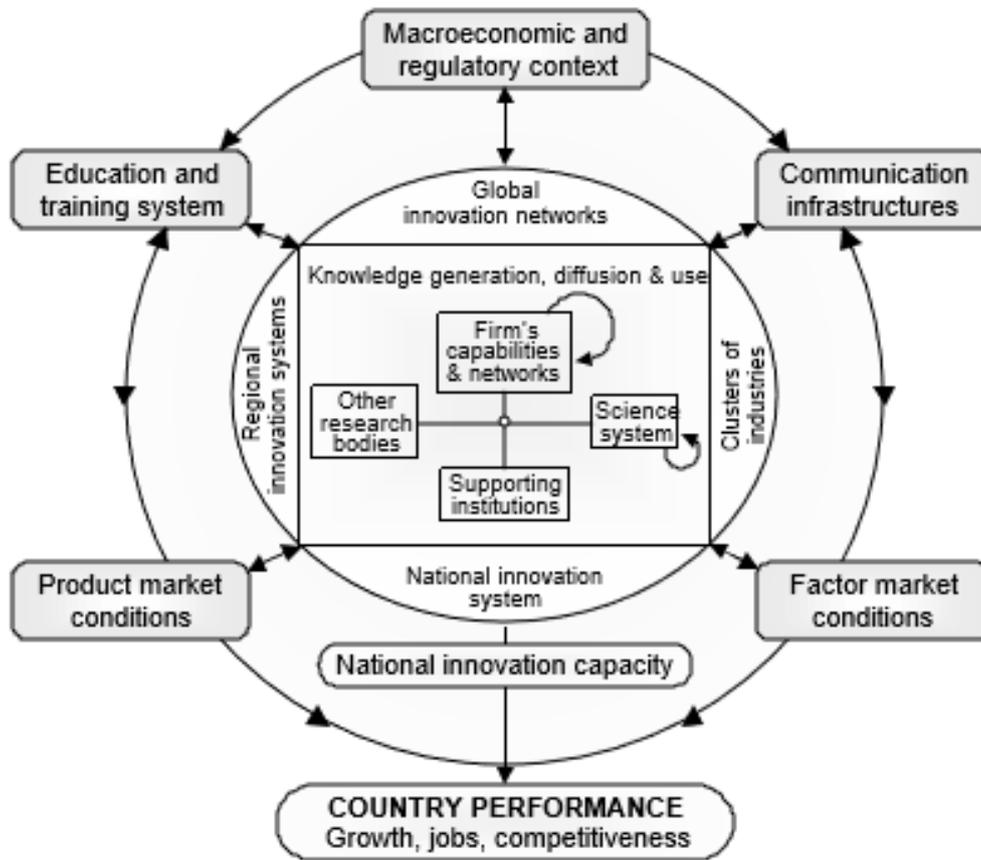
The broad definition of a National Innovation System includes all economic, political and social institutions and the activities associated with learning, searching and exploring. Among them, educational system, labour market, policies and institutions are identified (Figure 2.2).

In this context, policy makers should focus their attention on different types of interactions among players within and beyond the boundaries of the system. (Feinson, 2003)

The linkages depend on knowledge and resources, and how they flow between the different levels, and among organisations, companies and institutions considering both informal and formal ways. (Feinson, 2003)

Hence, it is not a one to one relationship, but the various players can perform more functions and activities in relation to different actors. One of the most representative examples is the university who is a knowledge provider, but at the same time it educates people.

Figure 2.2: Actors and linkages in the innovation system



SOURCE: (FEINSON, 2003)

### 2.3 Innovation system dimensions

On the analysis, it is crucial to distinguish from inside and outside, define its dimensions and determine the context because even if two countries are very similar, such as Sweden and Denmark, many differences can be identified.

Moreover, the most public policies influence innovation processes or the economy so, they are implemented at the national level. The national level is important because it captures the importance of the political and policy aspects of processes of innovation. It must be considered not just the geographical delimitation, but also the state and its power that constitute two important factors.

It might be identified not just national system of innovation; subnational and supranational are two other level of the approach. Various example of transnational

cooperation and relationship might be identified. At the same time, it might be sectoral within any of these levels. (Edquist, 2001)

Three dimensions or boundaries are identified for an innovation system (Edquist, 2001):

- Spatially/geographically;
- Sectorially;
- Functionally.



### 3 The Danish Innovation System

The Danish Innovation System is based on the role of innovation, considered the core element in the public policy and the main driver for the economic growth, both national and regional and not only from an economic point of view, but also for what concerns the welfare of the country and its citizens.

In the implementation of this strategy, the relationship between public and private sector becomes crucial. So, everything is linked to innovation that is developed inside firms or it can take place in new independent start-ups or through, what is called, a phenomenon of intrapreneurship inside an existing firm.

In any case, a fundamental role is played by other actors such as firms, higher education institutions and the public authorities who regulate the entire environment, and their interaction. This interaction must be developed and improved in order to facilitate the collaboration and exploit all the advantages that are possible to obtain. (Cornett, 2006)

In the Nordic countries, as in Denmark, the public institutions play an even more important role, they dominate the relations because they have a strong authority and importance.

Because innovation is the main driver, it is important to specify the different aspects of innovation. It must be distinguished by product and process innovation. Process innovation is the creation of a new process of production or another activity involved on the process of placing a product in the market. The other one is defined as the process of launching a new product independently from the production process. The figure below (Figure 3.1) shows very well this distinction and clarify the two concepts.(Cornett, 2006)

*Figure 3.1: Aspects of the concept of Innovation*

	<b>Old product</b>	<b>New product</b>
<b>Old process</b>	No innovation	Product innovation
<b>New process</b>	Process innovation	Product & Process innovation

SOURCE: (CORNETT, 2006)

Afterwards this important distinction, the analysis proceeds with a short background of the Denmark in the last century in order to understand what are the conditions that have determined the existing innovation system.

### 3.1 The origins of the Danish Innovation System

Denmark has had an economy predominantly based on agricultural sector where the main export product was grain. It was exported to UK until the entry of other producers such as Russia and USA. In response to increased competition, over the years, it started to produce and export processed agricultural products such as bacon, meat and cheese. Until the first years of 1900, Denmark economy was based on processed agricultural products. During the twentieth century, the industry started to grow successfully in some specific areas such as environmental technology, pharmaceuticals and medical instruments.

This was a result of the increased investments on R&D that allowed the success of this new industries.

The importance of the agricultural sector contributed to create the fundamentals of the modern innovation system. In this context, several associations and cooperatives were born, giving the possibility to invest and spread out technology innovations. The set of organisations supporting the development of primary sector assumed a crucial role on supporting the technological change, the development of extension services, the creation of agricultural colleges through the foundation of national and local association and education institutes (school and university)

The Danish Universities played an important role constituting the second pillar of the innovation system after the agricultural sector. The University of Copenhagen has been one of the most important hotspots for science and education in the Scandinavian region.

Later, in 1829, it was founded an engineering college that gave the basis for the future technical university (today it is called DTU).

This long process has continued during the century, creating a university system able to create high quality research known around the world.

Since '30s, there were a strong political presence of the social democratic party (SDP) and trade unions. The role for the formulation and implementation of economic policies has been the system of relationships between the government, trade unions and employers. This has contributed to create a labour market with a high degree of flexicurity, combining a high-income security for the employees with a high flexibility for the employers to hire and fire.

Moreover, since '60s, in Denmark it was emphasized social cohesion and equal income distributions based on various redistribution mechanisms.

Another factor was the predominance of SME that has created a different mode of innovation, making incremental innovation based on learning by doing, learning by using and learning by interacting, especially with customers and suppliers and later, as confirmed by data with universities and research institutes. (Edquist & Hommen, 2008; Fagerberg & Fosaas, 2014; Park & Lee, 2005)

### 3.2 The National Innovation System in Denmark

Denmark is one of best performers for what concerns the European Union as can be seen on the European Innovation Scoreboard report of 2015 (Figure 3.2). It is defined an innovation leader and it is just after Sweden. (European Commission, 2015a)

Figure 3.2: Performance of EU Member States Innovation Systems



AUTHOR'S ELABORATION FROM THE EUROPEAN COMMISSION (European Commission, 2015a)

The innovation index is determined through the analysis of various indicators that influence the innovation performance. The Table 3.1 shows these indicators for Denmark and for Italy to allow a fast comparison.

Table 3.1: Indicators of Innovation Index 2015<sup>1</sup>.

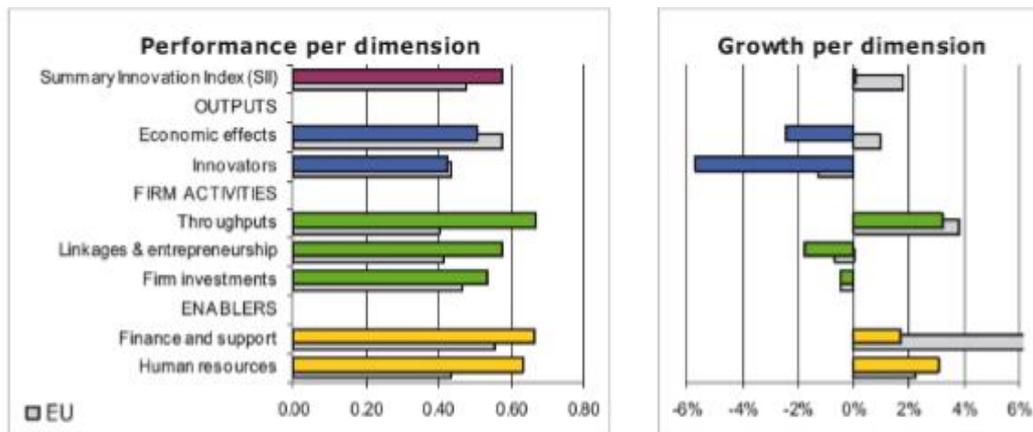
		DENMARK	Italia
<b>INNOVATION INDEX</b>		143,57	78,58
<b>FRAMEWORK CONDITIONS</b>			
<b>Human resources</b>			
1.1.1 New doctorate graduates	Percentage	3,27	1,52
1.1.2 Population completed tertiary education	Percentage	45,30	25,20
1.1.3 Lifelong learning	Percentage	27,70	7,30
<b>Attractive research systems</b>			
1.2.1 International scientific co-publications	Percentage	2093,57	558,64
1.2.2 Scientific publications among top 10% most cited	Percentage	13,37	10,44
1.2.3 Foreign doctorate students	Percentage	32,06	13,45
<b>Innovation-friendly environment</b>			
1.3.1 Broadband penetration	Percentage	26,00	5,00
1.3.2 Opportunity-driven entrepreneurship	Motivational index	11,09	1,81
<b>INVESTMENTS</b>			
<b>Finance and support</b>			
2.1.1 R&D expenditure in the public sector	% GDP	1,06	0,52
2.1.2 Venture capital investments	% GDP	0,06	0,05
<b>Firm investments</b>			
2.2.1 R&D expenditure in the business sector	% GDP	1,89	0,78
2.2.2 Non-R&D innovation expenditure	% turnover	0,29	0,57
2.2.3 Enterprises providing ICT training	Percentage	29,00	12,00
<b>INNOVATION ACTIVITIES</b>			
<b>Innovators</b>			
3.1.1 SMEs with product or process innovations	Percentage	34,65	32,67
3.1.2 SMEs with marketing or organisational innovations	Percentage	39,98	34,60
3.1.3 SMEs innovating in-house	Percentage	28,22	30,52
<b>Linkages</b>			
3.2.1 Innovative SMEs collaborating with others	Percentage	13,23	6,72
3.2.2 Public-private co-publications	Percentage	155,72	26,70
3.2.3 Private co-funding of public R&D expenditures	Percentage	0,03	0,01
<b>Intellectual assets</b>			
3.3.1 PCT patent applications	% (GDP in PPS)	6,05	2,16
3.3.2 Trademark applications	% (GDP in PPS)	10,82	7,52
3.3.3 Design applications	% (GDP in PPS)	7,70	5,78
<b>IMPACTS</b>			
<b>Employment impacts</b>			
4.1.1 Employment in knowledge-intensive activities	%	15,10	13,60
4.1.2 Employment fast-growing firms innovative sectors	%	4,52	3,12
<b>Sales impacts</b>			
4.2.1 Medium & high-tech product exports	%	47,84	52,07
4.2.2 Knowledge-intensive services exports	%	74,48	50,42
4.2.3 Sales of new-to-market and new-to-firm innovations	%	6,96	10,06

AUTHOR'S ELABORATION FROM THE EUROPEAN COMMISSION (European Commission, 2015a)

<sup>1</sup> The interpretation of the indicators is illustrated in Annex A (European Commission, 2015b).

The difference between the two countries is well marked, and Denmark excels in various sectors such as the lifelong learning, public-private co-publications and intellectual assets. Despite its leadership, as Figure 3.3 shows, the total growth rate is close to zero and far from 2%, the European average. It must be considered that the data were published in 2009 and they reflect the world crisis effect. Now Denmark shows a positive interest rate close to 2%. (Fredbo-Nielsen, 2010)

Figure 3.3: Danish performance and growth per dimension.



SOURCE: (Fredbo-Nielsen, 2010)

Denmark had a good performance in Human Resources, Finance and support and Throughputs. Instead Firm Investments, Linkages & Entrepreneurship and in Innovators and Economic Effects are not satisfying.

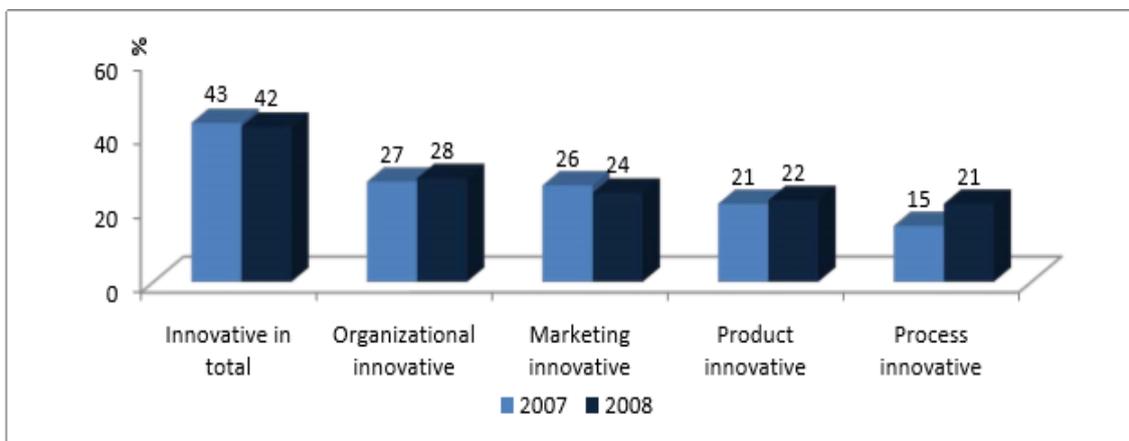
The rise in spillovers and spin-offs, a factor that characterise Denmark’s innovation, is due to Denmark’s proximity. In Denmark innovation is characterised by a majority of SMEs which undertake incremental innovation interconnected with “learning by doing and learning by interacting”. This context is favoured by Danish flexicurity model that support this interactive learning and innovation in the country.

In general, Danish firms are innovative, but it depends on sectors. Manufacturing and knowledge intensive business services are innovative, while finance and trade sector are less innovative. There is also a variance between SMEs and large firms, indeed , a study of the Danish Agency for Science, Technology and Innovation (DASTI) shows that 22% of the SMEs undertake R&D in 2008 against the 46% of large companies. Moreover, just

42% of SMEs were considered innovative instead, the large innovative companies were 71%. This is an important data because the SMEs constitute an important part of Danish economy. (Fredbo-Nielsen, 2010)

Interesting to have a look is the figure below (Figure 3.4) that shows innovative firms by type of innovation. From 2007 and 2008, the 22% have introduced new product, but the total number of innovative companies was decreased by 1 % in the two-year period. (Fredbo-Nielsen, 2010)

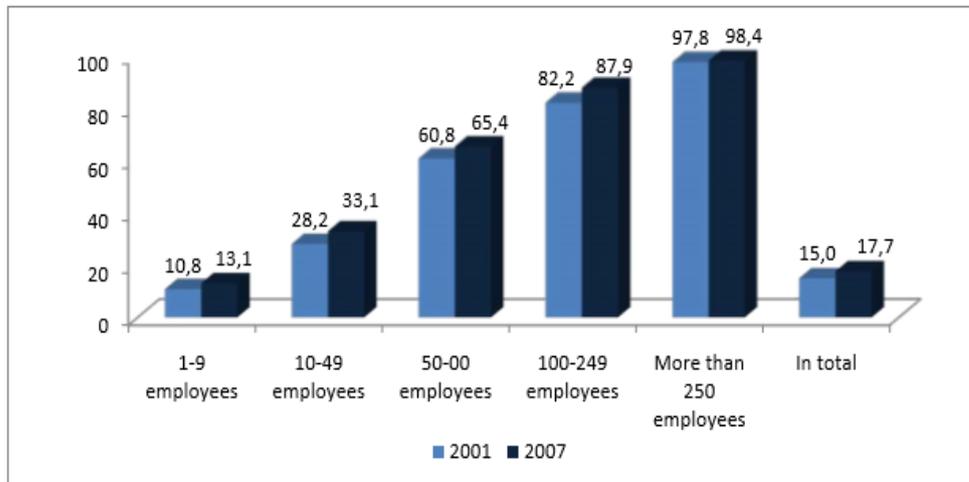
Figure 3.4: Innovative companies in Denmark by type of innovation



SOURCE: (Fredbo-Nielsen, 2010)

As told before, Denmark is well above the EU average in Human Resources (Figure 3.3) because of the high educated employees and the secure labour market. The graph below (Figure 3.5) shows as the large companies have the higher percentage of educated employees in the period 2001-2007. Higher educated employees in the companies are the 17.7 percent of the total employees. (Fredbo-Nielsen, 2010)

Figure 3.5: Higher educate (tertiary education) employees in the companies (Share of companies with highly educated employees in percent).



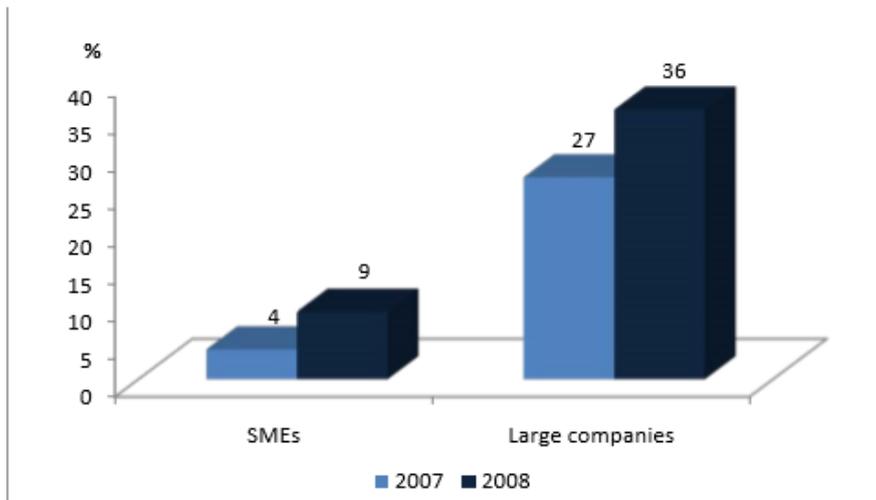
SOURCE: (Fredbo-Nielsen, 2010)

A low percentage of high qualified labour constitutes a constraint for private research and development so, also for innovation. This factor and the lack of financial resources are two limits for SMEs that have more difficulties to innovate and invest in new technologies.

The cooperation between companies and knowledge institutions is interesting to be analysed because, as it is possible to see on Figure 3.6, the 9% of SMEs cooperate with knowledge institutions compared to 36% of large companies. Anyway, the cooperation between the two players is increasing and this is a positive result. Moreover, it is proved that firms with cooperation usually experience a higher value and growth.

A key activity to boost and support innovation is financing that constitutes the major factor and driver for innovation processes and economic growth. Funding facilitates the production and the commercialisation of the research and knowledge and its use by the different players inside the innovation system. (Fredbo-Nielsen, 2010)

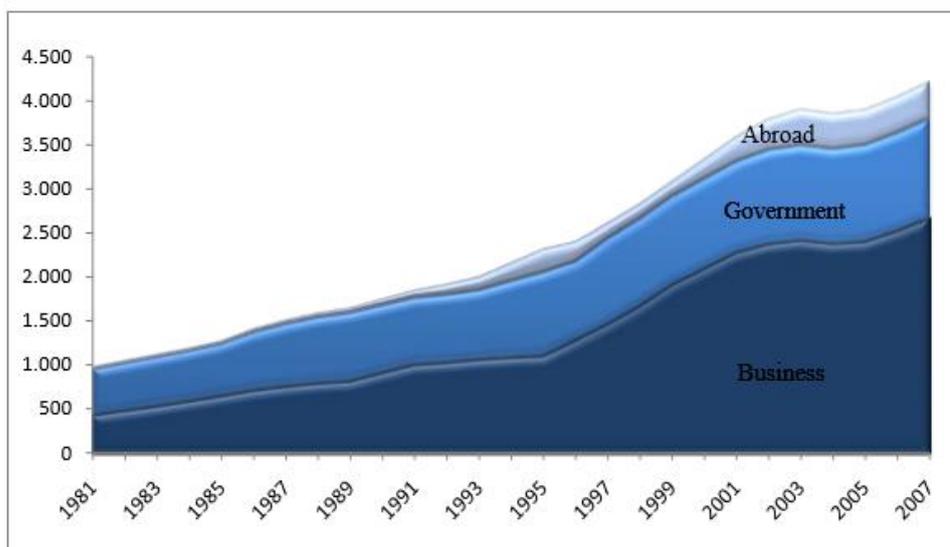
Figure 3.6: Cooperation between companies and knowledge institutes.



SOURCE: (Fredbo-Nielsen, 2010)

As shown on the figure below (Figure 3.7), the national Gross Domestic Expenditure on Research and Development (GERD) is increased so much during the last thirty years. According with the European objectives, the expenditure reached the 3% of the GDP. A small percentage of the expenditure comes from abroad where, mainly the large companies, have research and development projects financed by institutions outside Denmark. (Fredbo-Nielsen, 2010)

Figure 3.7: Gross Domestic Expenditure on Research and Development (GERD) - Million 2000 dollars, constant prices and PPP.

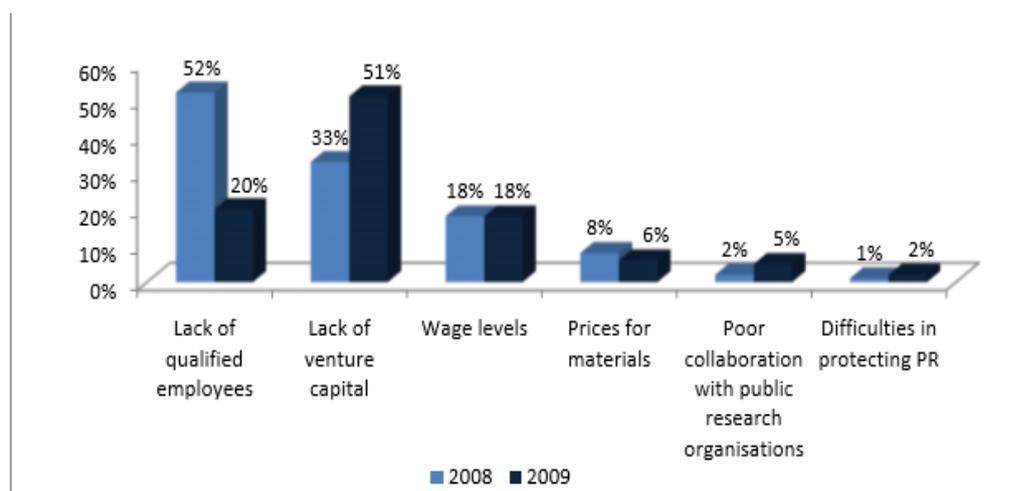


SOURCE: (Fredbo-Nielsen, 2010)

In Figure 3.8, it is possible to see the different barriers to R&D and innovation that the companies must face during the two-year period from 2008 to 2009.

In 2009, the 51% of firms declared that the main constraint was the lack of venture capitalists and 20% indicated that was for the lack of qualified employees. If the 2008 data are considered, the situation is almost the opposite. Even if the two-year period is contrasting, it remains clear that the main barriers are lack of qualified workers and venture capitalists. The third limit are the wage levels, probably too high to be sustainable. (Fredbo-Nielsen, 2010)

*Figure 3.8: Barriers to R&D and innovation - before and during the financial crisis*



Note: Enterprises were permitted to indicate up to two barriers

SOURCE: (Fredbo-Nielsen, 2010)

This is the Danish economic context for what concern the national innovation systems and the correlated activities. Even if the data are about the crisis period, they are interesting to show and explain in which context the analysis is operating and to understand better the relation between constraints and the policies undertaken. (Fredbo-Nielsen, 2010)

### *3.2.1.1 Innovation organisations and their recent development*

As written before, Danish business economy is based on small and medium enterprises (SME) which usually have not a strong interaction with the research institutions and universities. This can be a limit for innovation and growth because these small and medium firms usually have more internal and external barriers to invest resources on research and development activities compared to the capacity of big companies.

For this reason, it is necessary an innovation policy focused on cooperation between companies, university and research institutions. This strategy must be developed and implemented by the government.

Denmark is one of the smallest countries of OECD and this had consequences on this context. As explained by Maskell in 2004, in these kinds of countries the business community has strong elements of the village economy so, people from the manufacturing industry and domestic producers know each other either directly or indirectly.

Moreover, Maskell retained that the sectoral clustering in Denmark reflects the advantage of proximity in supply cost, but also in learning. In clustering process, the quality of financial services, spillovers and entrepreneurial competitions between companies seem to be informal. This contribute to create a village atmosphere where trust relations can be formed and used to create sustainable knowledge. This competition, as affirmed by Maskell, is a stimulus for entrepreneurial and productive activities.

Globalisation became the new challenge because with the increasing global competition, knowledge demand and new relations between the various actors are necessary to face the new market challenges.

Industrial policy during the '90s and 2000s influenced innovation system development, resulting in the concept of clusters. Clusters usually emerge where there are many companies creating economies of scale and scope, knowledge and technology base and a culture committed to innovation and entrepreneurship development.

In 2001, The Danish National Agency for Enterprise and Housing identified twenty existing and nine potential clusters of competence. The list, as it is possible to see on Table 3.2, includes the traditional ones, but also other Danish clusters that have linkages

with country and with traditional economic activities. Another interesting factor is that many Danish cluster are correlated to public utilities and public services, for example healthcare. In the creation and further development of these clusters, public regulation, technology procurement and demand have been fundamental drivers.

A high percentage of industries, looking to Danish manufacturing value added, exports and employment, appears to be low-tech. But low R&D intensity does not mean that the production is low knowledge intensive. It happens that industries use extensive knowledge inputs that are not registered as research and development activities. These components add high value to the final products. (Edquist & Hommen, 2008; Park & Lee, 2005)

Table 3.2: Danish clusters of competence, 2001.

	Existing clusters of competence	Potential (emerging) clusters
Agriculture	Fur (DK produces 40% of world's mink) Seeds (DK supply app. 50% of world market) Commercial gardening Pork (hog breeding, bacon factories) Dairy products	Øresund Food Network Organic food
Transport and communication	'The blue Denmark' (shipping companies, shipyards, equipment, sea transport) Telecommunication (especially mobile and satellite communication) Transport (inland, goods)	PR/communication
Public utilities and public services (especially healthcare)	Wind energy (windmills, turbines, various components) Water (water supply, wastewater treatment) Hearing aids Disability equipment Medical and pharmaceutical industry	Bio-informatics Waste handling
Mixed	Power electronics Cooling and heating technology, ventilation equipment Stainless steel Offshore industry Textiles and clothing Furniture Business tourism	Sensor technology Ubiquitous computing Movie and video production Toys and games

SOURCE: (EDQUIST & HOMMEN, 2008)

Moreover, the overall performance of the Danish Innovation System could be that innovations are developed in the creative industries, usually not retained a growth engine for the economy. Instead, in 2005, the creative industries contributed with the 5% of the GDP, employed the 12% of the population and were responsible for 16% of the total export.

In 2001, the Ministry of Science, Technology and Innovation (MOSTI) was created, and it was organised as the combination of two other ministry in order to optimise the functions concentrating the control on one entity.

The aim of this merger was to strengthen and take an effective strategy on innovation, education and research. So, the strategy was to link and improve the relationships between knowledge centres, educational institutions and the business community.

The Ministry of Science, Technology and Innovation (MOSTI) played a fundamental role in innovation, research, university and IT policy. It is of course a unique case that one ministry has control on many entities.

This was a result of the government agenda that aimed to increase and improve the interaction between public and private sector.

MOSTI tried to develop more efficient means of knowledge transfer to the private sector to promote the fostering economic growth based on knowledge.

As it is possible to see on Table 3.3 that show the interaction index for 21 OECD countries, Denmark is ninth instead Italy is just nineteenth. (Edquist & Hommen, 2008; Park & Lee, 2005)

*Table 3.3: Interaction index: benchmarking of the current interaction between knowledge institutions and the business and industry sector in 21 OECD countries.*

<b>Rank</b>	<b>Nation</b>
1	Finland
2	USA
3	Switzerland
4	Sweden
5	Canada
6	The Netherlands
7	Australia
8	Great Britain
9	Denmark
10	Germany

11	Ireland
12	France
13	Belgium
14	Japan
15	Austria
16	Norway
17	New Zealand
18	Spain
19	Italy
20	Greece
21	Portugal

SOURCE: (PARK & LEE, 2005)

Moreover, in 2003 the government issued the Appropriation Act's research packages, creating forty research centres in the more interesting and profitable fields such as food products, the environment and biotechnology.

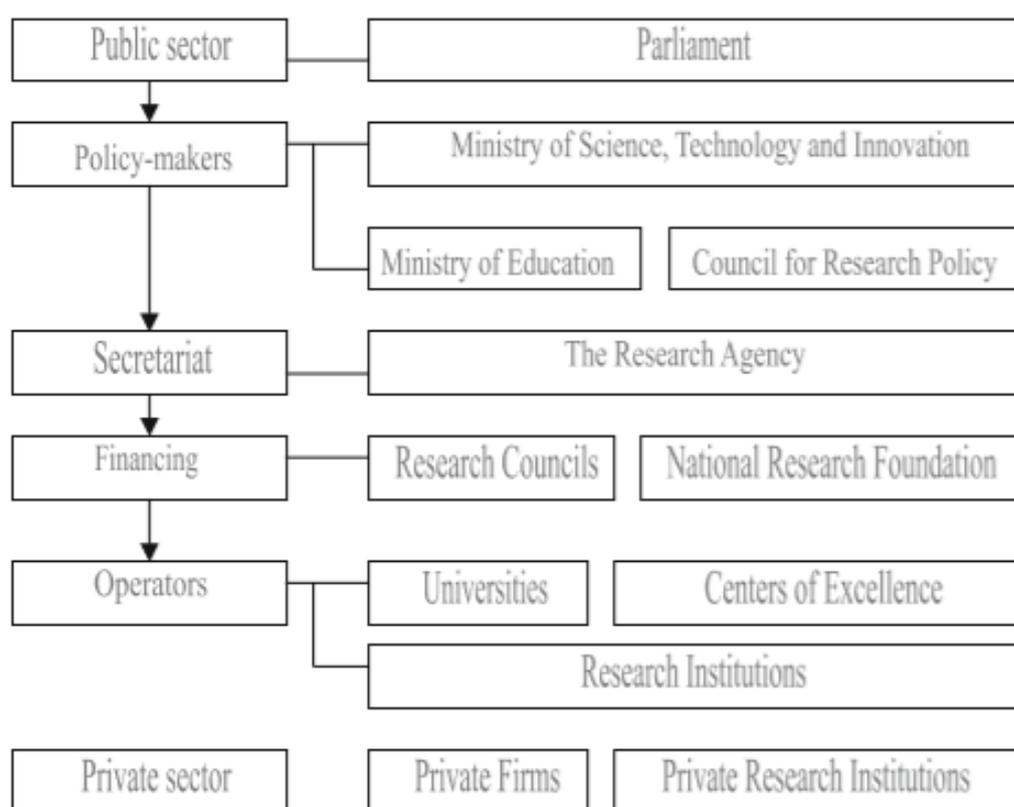
In 2002, after the Summit in Barcelona, the government targeted to invest 3% of GDP for research and innovation purposes before 2010.

Furthermore, the ministry started to develop a reform of the university with the aim to create a knowledge society and increase the innovation capability. Then it focused on the cooperation between the business sector and knowledge and research institutions adopting four objectives:

1. High mobility and interaction between the business sector, universities and knowledge institutions;
2. High tech and knowledge-based entrepreneurs;
3. Easy access to advanced technological knowledge for firms;
4. Increased focus on standardisation.

As in other countries, the innovation and research system is based on public and private sectors (Figure 3.9). (Edquist & Hommen, 2008; Park & Lee, 2005)

Figure 3.9: Danish Research and Innovation system.



SOURCE: (PARK & LEE, 2005)

In 2002, the private sector was contributing for 69% of the Total Expenditure on R&D (5.8 billion US dollars, 2.5% of GDP), while the public for just 31%. (Edquist & Hommen, 2008; Park & Lee, 2005)

Table 3.4: R&D expenditure in Denmark (1991-2005) (percent of GDP).

Year	Private sector	Public sector	Total
1991	1.0	0.7	1.7
1993	1.0	0.7	1.7
1995	1.1	0.8	1.9
1997	1.2	0.8	2.0
1999	1.4	0.8	2.2
2000	1.5	0.8	2.3

2001	1.65	0.75	2.4
2002	1.75	0.77	2.5
2003	1.77	0.79	2.56
2004	1.69	0.79	2.48
2005	n.a.	0.75	n.a.

SOURCE: (PARK & LEE, 2005)(Edquist & Hommen, 2008)

In 2004, the government created the Danish Research Agency, an independent public institution organised under the Ministry of Science, Technology and Innovation. It works as a secretariat for other of central authorities such as the Danish Council for Strategic Research, the Danish Councils for Independent Research, the Danish National Research Foundation, the Danish Research policy and the Danish Research Coordination Committee.(Park & Lee, 2005)

The Danish Research Coordination Committee is responsible to coordinate and promote the cooperation between the research councils and the other actors. It is composed by the members of the three organisations: the Danish National Research Foundation, the Council for Independent Research and the Council for Strategic Research. (Meissner, 2006)

Danish National Research Foundation provides funds for large scale research activities and supports other projects for innovation. It is composed by members from the public sector, but also private sector persons are invited to participate. (Meissner, 2006) In 2015 the agency provided 60 million of Euro to public research institutions. (Wolfgang Polt, Maximilian Unger, Michael Ploder, Daniel Wagner-Schuster, Torben Bundgaard Vad, Samuel Palmquist, 2015)

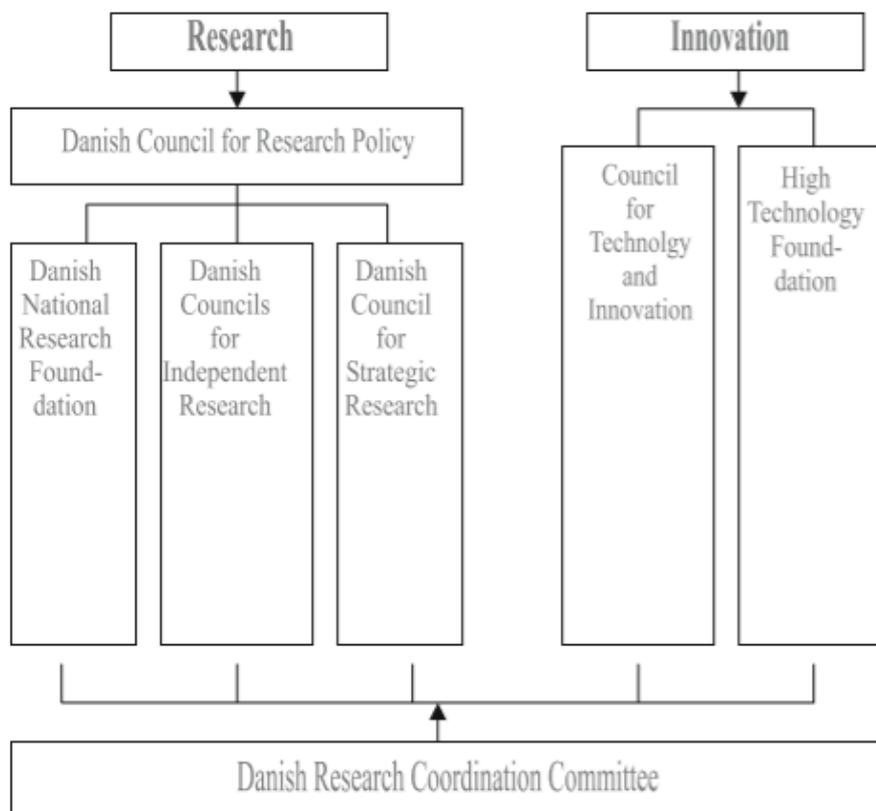
Danish Councils for Independent Research grants and supports projects or activities in public research institutions based on bottom up ideas so, ideas coming from the academia and researchers. In 2015 provided 140 million of Euro. (Meissner, 2006; Wolfgang Polt, Maximilian Unger, Michael Ploder, Daniel Wagner-Schuster, Torben Bundgaard Vad, Samuel Palmquist, 2015)

Danish Council for Strategic Research gives support on research projects and initiatives based on political priorities. Moreover, it aims to increase the interaction between the private sector and public institutions promoting cross-disciplinary research.

In 2004, the government, to strengthen innovation and research capability, created new research councils (Figure 3.10) to build an innovation promotion system(Park & Lee, 2005):

- Council for Technology and Innovation advises the ministry (MOSTI), and administrates and develops the initiatives covered and implemented on innovation and technology by the government. It consists of members from the academia and private organisations.
- High technology Foundation (or Innovation Council) has the important role to create cooperation between privates, ministries and public institutions trying to encourage innovation issues, assess the impact of innovation and provide recommendations on national strategy.

Figure 3.10: The Research and Innovation council system.



SOURCE: (PARK & LEE, 2005)

In 2001, the Danish universities were transferred from the Ministry of Education to the MOSTI for what concerns research activities. Then, in 2003 the University Act detailed the universities' obligation to create and disseminate knowledge scientific methods and research results.

Research institutes provide research-based knowledge and collaborate with the universities to educate new researchers.

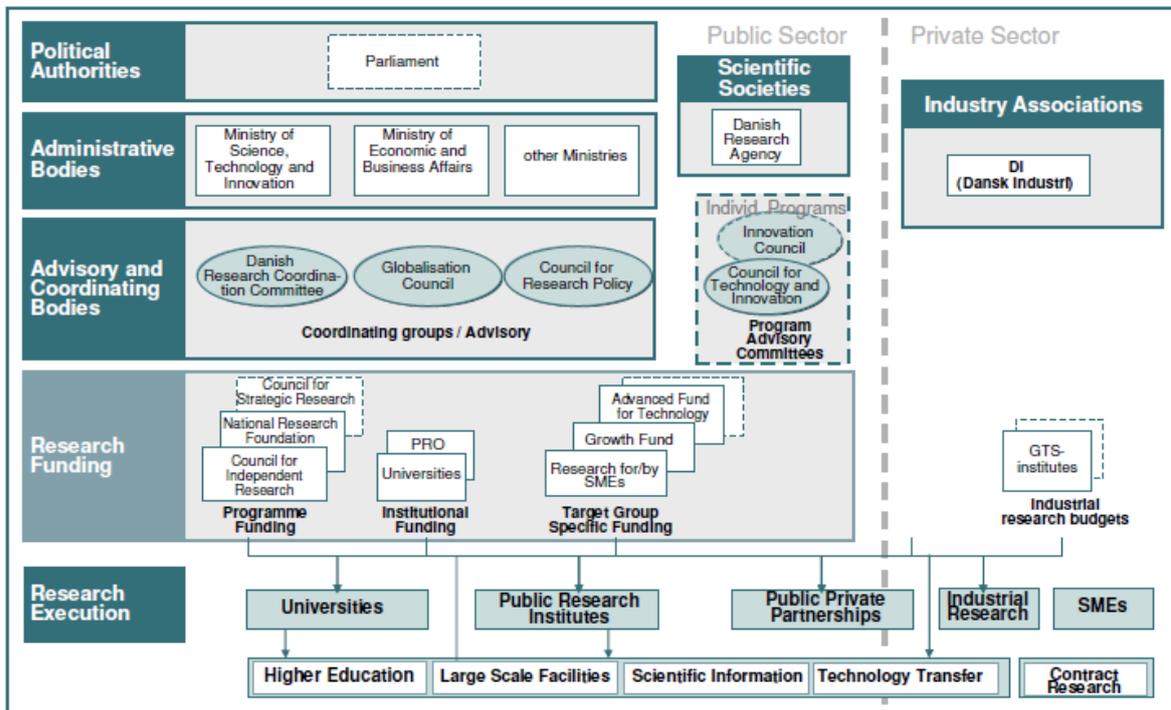
Moreover, there are ten Authorised Technological Service Institutes (GTS Institutes) which are independent and non-profit organisations. They contribute to provide knowledge and competencies to the business sector for a fee. They constitute a fundamental support to the small and medium enterprises for what concerns technological knowledge.

The Danish innovation system is completed by seven science parks and eight incubators distributed in all the regions.(Edquist & Hommen, 2008; Park & Lee, 2005)

As result of all the policies and reforms implemented during the recent years, the figure below (Figure 3.11) presents a complete representation of the Danish Innovation system with all the organisations and institutions involved. Some new organisations, introduced with recent reforms, will be presented later, but they have not a strong impact on the entire organisation. (Meissner, 2006)

The main organisations were already presented before following the development based on national policy and reforms. Other organisations will be presented later, and some aspects will be analysed better on the following chapter discussing the Research and Funds in Denmark.

Figure 3.11: Structure of Danish national Research and Innovation System



SOURCE:(MEISSNER, 2006)

According to the concepts introduced, it can be identified three fundamental points of the innovation system:

- Innovation and research connected to business initiatives;
- Education reform;
- Collaboration and interaction between private and public sectors.

The first point is very important because the interaction and the collaboration between them generate growth and development. The government established knowledge and higher education centres in order to facilitate the conversion of knowledge into profitable business initiatives. Anyway, this collaboration between private and public is well underlined in the innovation system representation where they are pictured side by side.

In 2002, the government issued the Better Education and Action Plan which aimed to boost innovation improving education programs.

Then, the government created the Entrepreneurship Plan (2003) with the objective of enhance the enterprise culture inside the education system.

With these two plans, Denmark built a strong basis for innovation and entrepreneurship and has motivated students in starting their own businesses.

In 2007, the innovation strategy was intensified with the Danish Agency for Science, Technology and Innovation (DASTI) which was responsible of promoting innovation and dissemination knowledge between institutions and companies. DASTI created the Innovation Action Plan 2007-2010. The program was renovated in 2010 when the action plan 2010-2013 was published. The plan aims to increase the cooperation between companies and universities. The government set aside about DKK 3.5 billion for the period 2010-2013 and more than 50 initiatives were being implemented towards 2013. (Fredbo-Nielsen, 2010)

In the same year, the Danish Government has presented the globalisation strategy with the following aims:

- Accomplish world top level education;
- Strong and innovative research;
- More high-growth start-ups;

Renewal and innovation in order to attain a strong competitive power and cohesion.

In response to the new global context, DASTI launched a new initiative, the Innovation Consortia Scheme which aimed to improve the interaction between companies and research-knowledge organisations through the realisation of four focuses:

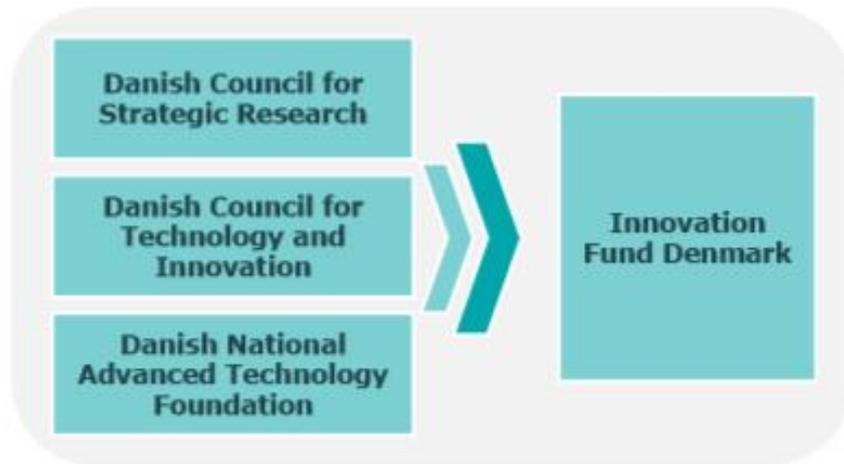
1. Collaboration between research institutes and companies
2. Access to the high skilled workforce
3. Technological services
4. Commercialisation of research

Objective of the action plan was also to support and strengthen the SMEs and push them to collaborate on producing and using knowledge. This was so important for a country where the large part of companies have a small or medium size.

In the second action plan published by DASTI, the focus has slightly been modified. It became more international, aiming to attract firms from abroad to participate in innovation and research projects with Danish institutes and companies. It is recognised that new possibilities for knowledge spill-over and the identification of current knowledge is facilitated with the increasing globalisation and internationalisation which

is a driver for a further knowledge combination and incremental innovation. (Edquist & Hommen, 2008; Fredbo-Nielsen, 2010; Park & Lee, 2005)

Figure 3.12: Innovation Fund Denmark.



SOURCE: (Innovation Fund Denmark, 2015)

In 2014, it is established Innovation Fund Denmark, a new institution created by a broad party-political agreement with the purpose to consolidate three existing bodies: the Danish Council for strategic Research, the Danish National Advanced Technology Foundation and Danish Council for Technology and Innovation (Figure 4.12). The aim is to concentrate the resources from three different organisations in a single entity. In this way the part about the Research Funding bodies is now different from the previous scheme. The difference is not so important because the purpose is the same, it is just an optimisation of the entire system. (Innovation Fund Denmark, 2015)

In 2015, Innovation Fund Denmark provided a high share of funds to public research organisations, SMEs, private research organisations and individual researchers. It supported its activities with a total of 213 million of Euro. (Wolfgang Polt, Maximilian Unger, Michael Ploder, Daniel Wagner-Schuster, Torben Bundgaard Vad, Samuel Palmquist, 2015)

The figures below (Figure 4.13, Figure 3.14) shows very well the improvements provided by the establishment of Innovation Fund Denmark.

Figure 3.13: The previous strategy

	<b>From ...</b>
<b>Mission, vision and objectives</b>	Three separate entities with different target groups and different foci
<b>IFD's investments</b>	"Funding"
	14 different <i>funding instruments/funding opportunities</i>
<b>Organisation and governance processes</b>	Strict divides between the target groups for the funding instruments and positioning within the value chain
	More advantageous funding opportunities within certain parts of the value chain for certain institutions
<b>Presentation and user access</b>	Administrative secretariat
	Differing decision-making models for processing applications
<b>Presentation and user access</b>	Diversified governance processes with variable processing times
	Different layout on the respective websites
<b>Presentation and user access</b>	Major differences in the formalities of application procedure

SOURCE: (Innovation Fund Denmark, 2015)

Figure 3.14: The new strategy

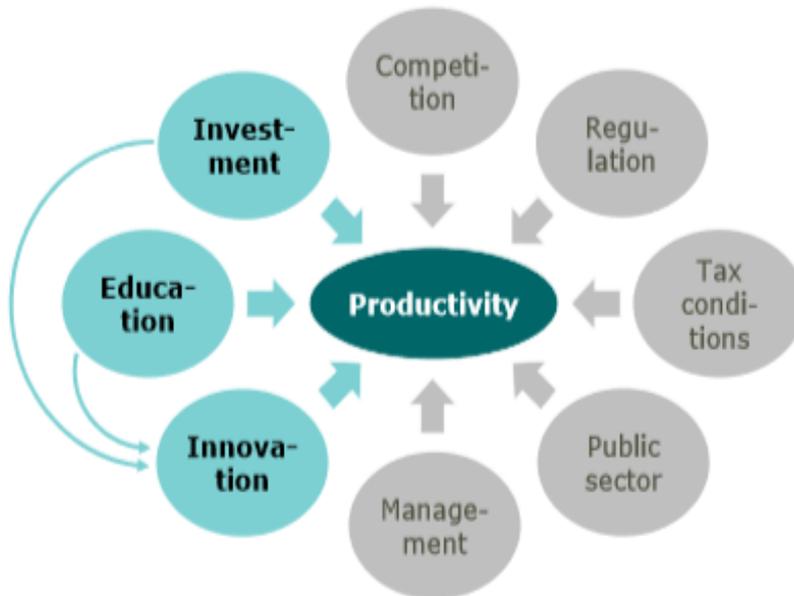
	<b>To ...</b>
<b>Mission, vision and objectives</b>	A single fund with a consolidated mission, vision and objective enacted in national law
<b>IFD's investments</b>	"Investments"
	Investments in "Large Scale Projects", "Growth Projects" and "Talents"
	IFD's investments facilitate partnerships between different target groups and are diversified along the value chain
<b>Organisation and governance processes</b>	Consistent financing opportunities for every type of institution along the value chain to the greatest possible extent
	A fund with high level inhouse professional skills in organisation
	Decision-making responsibility lodged strictly with the Board
<b>Presentation and user access</b>	Efficient, more flexible governance processes lodged with the Board
	Easily accessible fund with a single website providing an at-a-glance view of application opportunities in Danish and English for all target groups
<b>Presentation and user access</b>	Up-to-date, consistent and simplified application materials

SOURCE: (Innovation Fund Denmark, 2015)

As result of this merger, the new institution has different perspective demonstrating to understand that productivity and growth depend on multiple factors and not just one.

For this reason, a multisided institution is needed in order to have a wider view and contribute to increase the national productivity from several angles (Figure 3.15). (Innovation Fund Denmark, 2015)

Figure 3.15: Innovation Fund Denmark and its contribution on the productivity.



SOURCE:(Innovation Fund Denmark, 2015)

Innovation Fund Denmark’s mission aims to invest in ideas, knowledge and technology to provide benefits for the Danish society.

It identifies its vision on Entrepreneurship, partnerships and an international outlook thrive so that idea, knowledge and technology may be translated into opportunities and businesses and solutions for the entire society.

It tries to stimulate growth and employment and solutions to key societal challenges though the following strategy:

1. Innovation and technological advances
2. Interdisciplinary alliances
3. Thriving entrepreneurship
4. Research excellence
5. A dynamic international outlook

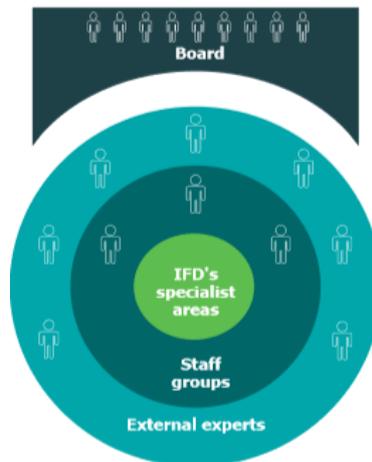
Innovation Fund Denmark has identified six research areas for its strategy, keeping into consideration its investments and objectives in order to ensure coherence between them.

It focuses on the following areas:

1. Bioresources Food and Lifestyle
2. Trade, Service and Society
3. Energy, Climate and Environment
4. Production, Materials, Diferisation and ICT
5. Infrastructure , Transport and Construction
6. Biotech, Medico and Health

(Innovation Fund Denmark, 2015)

*Figure 3.16: The governance structure.*



SOURCE: (Innovation Fund Denmark, 2015)

Innovation Fund Denmark is governed by a three parties governance structure (Figure 3.16):

1. Board composed by nine members with research and industry expertise. The board determines the strategic investment priorities, makes investment decisions and defines awards policies;
2. The Staff and Executive Management is composed by expert employees in project management, research and innovation disciplines and administration. They support the board on the evaluation and decision-making process;

3. External experts who are specialised in research and commerce. They are paid for each application and they sign contracts with the Fund on non-disclosure, remuneration and impartiality.

(Innovation Fund Denmark, 2015)

### 3.2.1.2 *The Danish Innovation Centres (ICDKs)*

During the last years, the internationalisation and globalisation of businesses have become fundamental to determine business success. Moreover, the internationalisation of research and education institutions become crucial to innovate and create value. Of course, these factors are considered preconditions for the welfare and success of a country, in this case Denmark.

The Innovation Centres are offices based abroad, in strategic countries, which offer R&D information and innovation, and support the Danish Small and Medium Enterprise on business development in foreign markets.

In 2006, the Ministry of Foreign Affairs of Denmark, in collaboration with the Danish Agency for Science, Technology and Innovation (DASTI) under the Ministry of Higher Education and Science, has established the first Innovation Centre in the Silicon Valley. Since 2006, Denmark has continued to develop its network abroad through these kinds of centres and it has opened in total seven ICDKs.

The table below shows all the centres and the year of foundation.

*Table 3.5: The Danish Innovation Centres*

<b>City</b>	<b>Country</b>	<b>Year</b>
Palo Alto (Silicon Valley)	USA	2006
Shanghai	China	2007
Munich	Germany	2008
Sao Paulo	Brazil	2013
Seoul	South Korea	2013
New Delhi/Bangalore	India	2013
Tel Aviv	Israel	2016

*SOURCE: AUTHOR'S ELABORATION*

The Innovation centres operate with the Danish companies and higher education institutions, but at the same time they collaborate and establish relationships with foreign institutions, organisations and firms.

The Innovation Centres offer various kind of services:

- Market analysis
- Partner matchmaking
- Review of business plans
- Arranging contacts
- Customised visit for delegations

They create a bridge between Denmark and foreign markets, R&D and innovation systems allowing Danish player to interact with foreign actors and exploit new opportunities. All the services offered by the centres, aim to help Danish companies, start-ups, researchers, universities to access to local network, market and knowledge.

The Innovation Centres has an important role in the Danish Innovation System and, as it is possible to see on the table below (Table 3.6), the data, provided by the Eurofound Website, show how they have a discrete number of clients and cases. The data about the Innovation Centre of Tel Aviv are not present because the analysis has been done in 2014.

Anyway, it is interesting to notice that the Innovation Centre in Shanghai has a strategic role. They have 107 clients and almost the double of cases for clients. This, of course, constitutes a success. Moreover, if we have a look to the Innovation Centres opened in 2013, Sao Paulo, Seoul and New Delhi/Bangalore, have already a discrete number of clients and also cases for clients, proving the strong collaborations that they are able to set with them.

Table 3.6: Number of Commercial Clients in 2014.

Danish innovation Centre	Number of clients	Number of cases for client in total
Silicon Valley	52	87
Shanghai	107	171
Munich	36	48
New Delhi/Bangalore	12	21
Sao Paulo	9	17
Seoul	37	53
<b>Total</b>	<b>253</b>	<b>397</b>

SOURCE: (EUROFOUND, 2018)

The ICDKs are important institutions and constitute a strong physical presence in various strategic places around the world. They have a double nature, they are placed in an international context, deleting borders between countries, but at the same time they have the capacity to enter in the local environment and build strong relationships. This determines the success of the collaboration between the different actors allowing new synergies and partnerships.

In spite of this double nature and this advantage, they have to increase the effort to gain visibility, especially in Denmark, the country that they have to represent and help to support its business sector and higher education institutions. (Eurofound, 2018)

### 3.2.1.3 European Union policies and Denmark

The European policy is influencing the Danish national innovation system. European Union launched several initiatives to boost innovation in the European countries.

In 2000 European Research Area (ERA) and the Lisbon strategy had the aim to facilitate the research and innovation exchange across European members and to coordinate and push national policies in the same directions. (Fredbo-Nielsen, 2010)

The European strategy is of course important because the European Union can be defined such a supra-national innovation system that have consequences on the national ones.

### 3.3 The Regional Innovation System in Denmark

The National Innovation System is very important, but without an appropriate regional strategy, it will be completely non-effective. The regional growth is not an exogenous or independent phenomenon, but it is derived from the ability of the local companies to create value and generate income. The regional innovation system becomes effective with the application of policies and projects developed and planned in the national system. This seems an easy task, but it is complex, and it is hard to maximise the benefits exploiting the national programs.

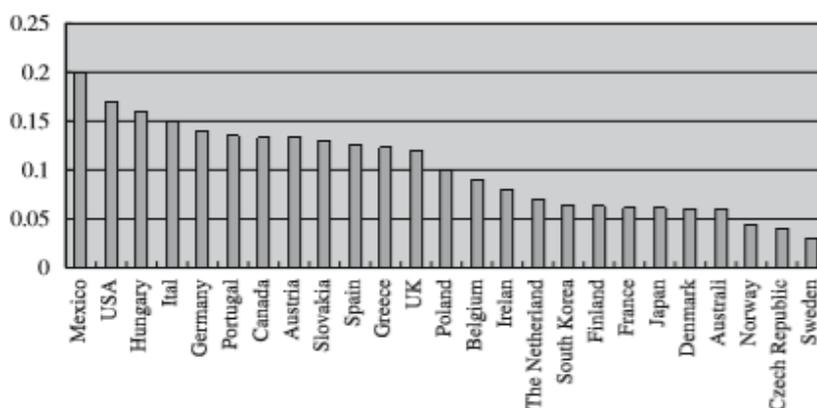
So, the crucial factor is to increase the ability to stimulate and support entrepreneurial activities and the capacity to innovate both on the regional and local level, not just considering the national one.

An important aspect to consider, it is the high concentration of SMEs and firms not located close to knowledge and research institutions. There is the need to implement an innovation policy able to reach these objectives. (Cornett, 2006)

The Danish government, in order to respect the objectives introduced before, set to meet a reasonable economic balance between the regions, recognising as a key factor to the national economic growth and to the effectiveness of the national policies.

Denmark has achieved a high degree of regional balance if compared with other European countries. As Figure 3.17 shows, Denmark stands the first position for low disparity between EU members. (Park & Lee, 2005)

Figure 3.17: Regional disparities in GDP per capita in 25 OECD nations.



SOURCE: (PARK & LEE, 2005)

Moreover, Table 3.7, shows as GDP per capita in the metropolitan areas in Denmark is similar to the major cities in Europe confirming that the difference between regions is very low. (Park & Lee, 2005)

*Table 3.7: GDP per capita in the cities relative to surrounding areas (1995-2000)*

Metropolis/Hinterland	1995	1996	1997	1998	1999	2000
Metropolitan area/the rest of Denmark	1.38	1.36	1.36	1.34	1.34	1.36
Glasgow–Edinburgh/the rest of Scotland	1.31	1.34	1.35	1.38	1.39	1.39
Berlin/the rest of Northeast Germany	1.59	1.50	1.45	1.43	1.39	1.39
Stockholm/the rest of Central and Southern Sweden	1.31	1.33	1.39	1.42	1.44	1.45
Helsinki/the rest of Southern Finland	1.42	1.45	1.41	1.48	1.50	1.51
Dublin/the rest of Ireland	1.48	1.50	1.50	1.54	1.54	1.54
Amsterdam/the rest of the Netherlands	1.53	1.54	1.57	1.60	1.64	1.62
Hamburg/the rest of Northwest Germany	1.80	1.83	1.85	1.87	1.90	1.92
Munch/the rest of Bavaria	1.94	1.97	1.98	2.01	2.04	2.00
Brussels/the rest of Belgium	2.23	2.28	2.26	2.29	2.28	2.29

SOURCE: (PARK & LEE, 2005)

The government has been making various efforts to decrease disparities and develop all the regions because marginal and underdeveloped areas still exist and, for this reason, a regional economic growth strategy is needed.

The government launched the Danish regional growth strategy in 2003. Moreover, it started to join forces with regional and local parties to carry out initiatives such as regional growth partnerships and an increased transport allowance in marginal regions. These activities are necessary to boost economic growth and stimulate innovation, entrepreneurship and human resources.

These initiatives were well supported by the government with dedicated funds in 2004 and they obtained a good performance.

The crucial point of the regional growth strategy was to spread the economic growth to outer regions and bring them to the same economic level of regional centres. In 2003 the Ministry of Economic and Business Affairs, the Ministry of Food, Agriculture and Fisheries, and the Ministry of Interior and Health provide 60 million DDK, 25 million DDK and 16.9 million DDK, respectively.

Moreover, the government, considering the economic context such as main activities and low technologies companies in the marginal areas, focused on eight resource areas

based on knowledge instead of high tech capacity in order to support the outer regions.(Park & Lee, 2005)

*Table 3.8: Identified industrial resource areas.*

Industrial area	Value added (%)	Employment (%)	Export (%)
Food	14	14	21
Construction, housing	13	15	7
Medico/health	3	2	4
Transport/communication	11	12	20
Environment/energy	6	4	6
Tourism/leisure	6	6	3
Consumer goods	4	6	3
Service	33	30	23

SOURCE: (PARK & LEE, 2005)

It is important to underline that the eight areas, as can be seen in Table 3.8, cover the 90% of the economic activities in Denmark.

The Danish regional growth strategy focuses on balanced regional development. There are 7 areas less developed: Funen, North Jutland, Storstrom, Aarhus, Bornholm, South Jutland and Viborg.

In order to evaluate and analyse the regional growth plan, it is interesting to have a look at the personal income in these areas that constitutes a good indicator of whether the strategy is working or not. The table below (Table 3.9) shows this data for different zones of the regions introduced before. (Park & Lee, 2005)

*Table 3.9: Average personal income in the marginal areas (2000-2002)- (1000 DKK).*

Area	2000	2001	Growth rate (%)	2002	Growth rate (%)
Nakskov	164.1	172.9	5.4	184.9	6.9
Nykøbing. F.	181.6	188.5	3.8	198.7	5.4
Rønne	180.9	187.7	3.8	196.8	4.8
Marstal	169.4	178.5	5.4	188.5	5.6
Rudkøbing	171.5	178.7	4.2	190.1	6.4
Svendborg	183.6	191.3	4.2	203.3	6.3
Ærøskøbing	171.4	180.9	5.5	189.6	4.8
Tønder	194.4	199.2	2.5	207.5	4.2
Grenaa	189.6	197.2	4.0	206.2	4.6
Samsø	177.0	188.5	6.5	193.1	2.4
Morsø	184.9	194.8	5.4	200.1	2.7
Fredrikshavn	184.5	192.2	4.2	203.3	5.8
Hjørring	189.2	198.0	4.7	210.4	6.3
Læsø	176.5	181.0	2.5	193.0	6.6
Skagen	187.7	197.0	5.0	211.2	7.2
National average	203.8	212.3	4.2	221.8	4.5

SOURCE: (PARK & LEE, 2005)

As it can be easily seen, in 2001, the personal income in the marginal areas was higher than the national average. In 2001, the average growth in the outer areas was 4.7% against the 4.2% of the national one. The year later the difference was higher, in these 15 areas the average was 5.33% instead the national one of 4.5% (Figure 3.9). (Park & Lee, 2005)

*Table 3.10: Average income growth rate in the nation and marginal areas (2000-2002)*

	Marginal areas	National average	Lower income growth areas than national average
Average growth rate in 2001 (%)	4.47	4.2	Nykøbing F., Rønne, Tønder, Grenaa, Læso
Average growth rate in 2002 (%)	5.33	4.5	Tønder, Samsø, Morsø

SOURCE: (PARK & LEE, 2005)

This means that the policy strategy is working, and the disparity is decreasing. Another aspect that confirm this trend, is the decreased number of zones with an average lower than the national one. Of course to obtain the same level of income growth, the continuous implementation and development of the strategy is needed.(Park & Lee, 2005)

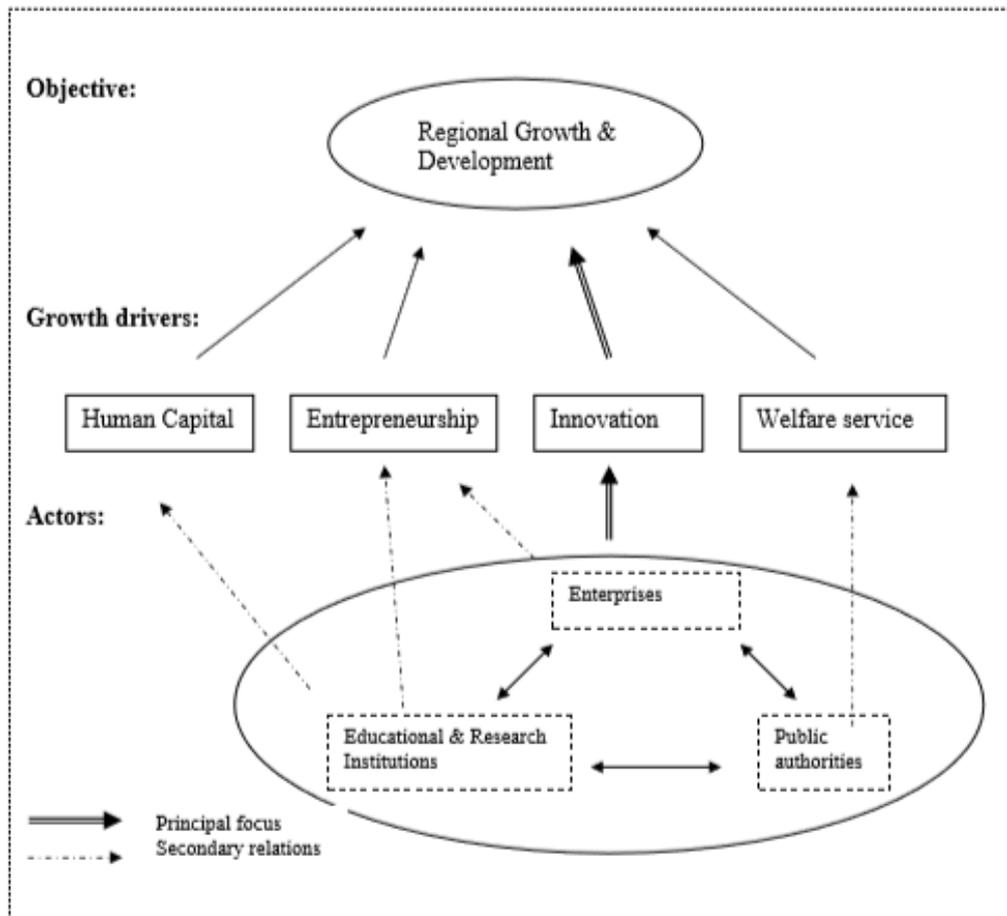
In this context, the knowledge and the innovation assume a twofold role. In the short run, innovation and knowledge creation are instruments to adapt the economic structure to the industrial change as a response to changes in the competitive environment. Instead, in the long term perspective, the two factors are prerequisites for a successful restructuring of the economy.(Cornett, 2006)

As for the national system, the focal point is the interaction between the companies and the external environment as a part of the network of relationships. To understand the system, it must be analysed the changing regional development strategies and the policy plan for the implementation with particular attention to innovation and economic and social development on the background of the regional system reorganisation.

In the Danish White paper (2004), the Ministry of Interior and Health affirms that innovation is the main driver among the four drivers in a regional growth policy.

The graph below (Figure 3.18), a sketch of the triple helix model, shows the regional growth model that helps to understand better the mechanism and how innovation is introduced in the regional economic growth. (Cornett, 2006)

Figure 3.18: A regional growth model.



SOURCE: (CORNETT, 2006)

The welfare system is important for two reasons:

- The Danish flexicurity system is a precondition for a flexible labour market and a reasonable income.
- The system constitutes as a selection with regard to entrepreneurial behaviour and it allows to focus on business opportunities and innovative projects rather than on the way to find income resources.

In relation to the importance of innovation and technology, the government established four information technology centres in Western Denmark to improve the spread of knowledge and technology between universities and research organisations and companies. These centres will be an instrument to support the promotion of business and competence clusters.

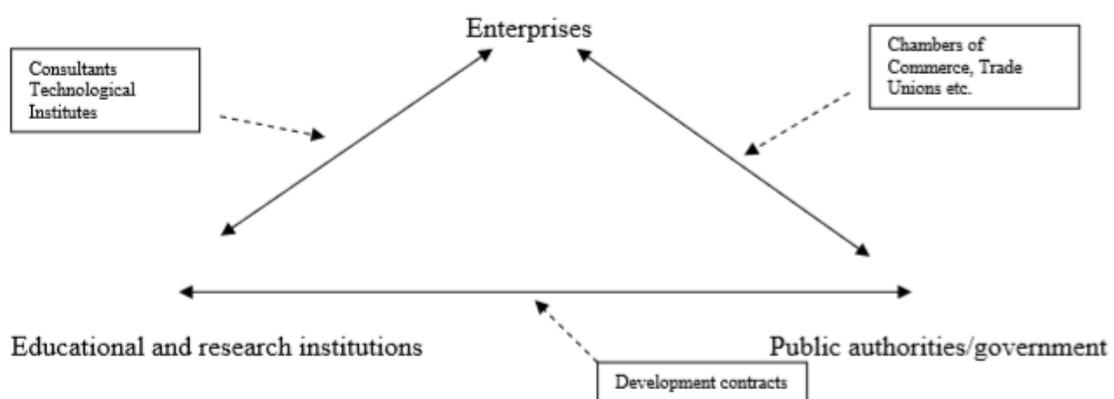
These technology centers were established in 2004 in the main cities of the region such as Aarhus, Aalborg, Sonderborg and Odense. The government sustains that information technology (IT) is an important driver of economic growth.

In Denmark, during the last years, first the social democratic government and then the liberal conservative one, launched new projects and initiatives for Western Denmark such as regional assessment for new policies, relocation of agencies and innovative growth strategy.

Innovation policy became an instrument in regional policy, but this requires an effective system of knowledge dissemination. This is the role of business incubators, science parks and technology centers.

On the dissemination of knowledge, it becomes crucial the role of different actors and the partnerships developed among them. It is the set of relationships already described in Figure 3.18 and recalled with more details in Figure 3.19. (Cornett, 2006)

Figure 3.19: Relationships on the Innovation Triangle.

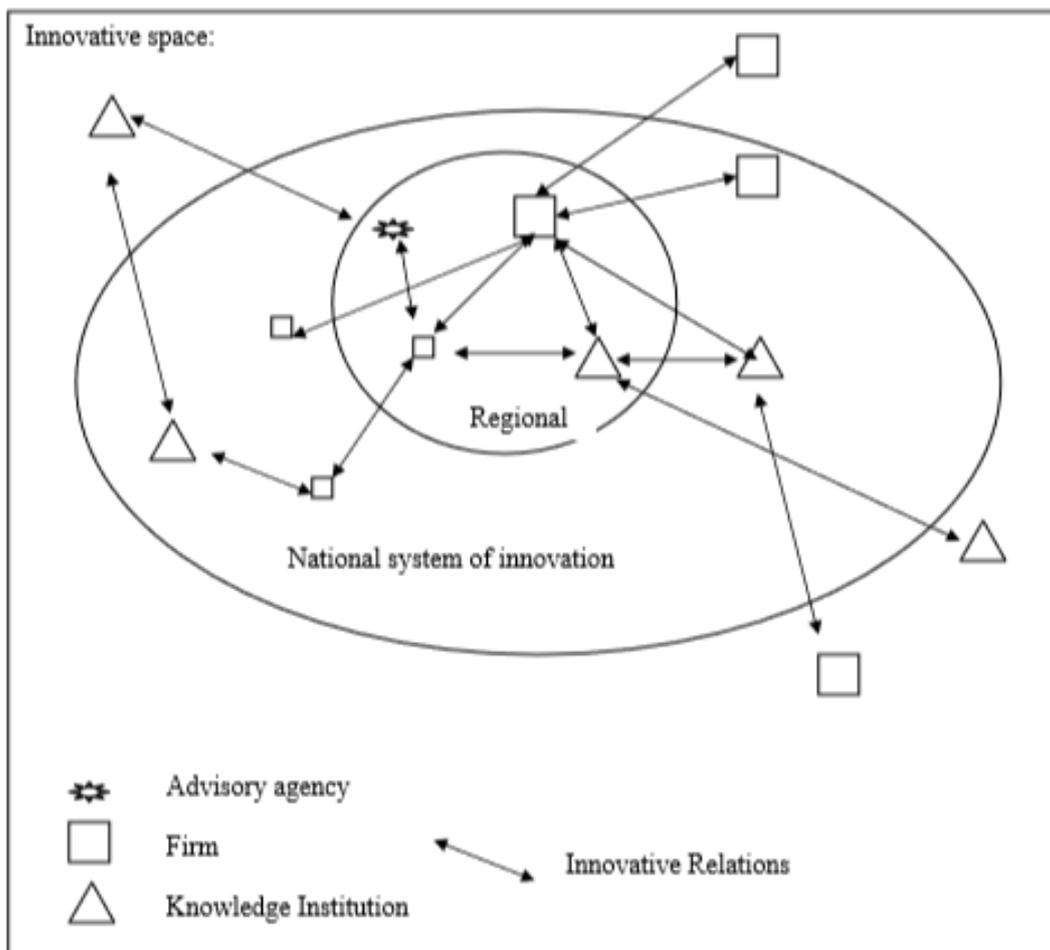


SOURCE: (CORNETT, 2006)

A crucial role is played by the advisory system that constitutes a bridge between firms and universities. On the other side, a similar role is given by chambers of commerce and professional institutions. And then, between education organisations and public institutions, development and funds contracts are fundamental and constitute the basis to improve the knowledge system.

The innovative space created (Figure 3.20) is not necessarily spatial or geographical bounded so, policies must focus on the scope rather than spatial based. The innovation mediators and business services agencies must be local connection points for knowledge in order to transmit new technology and procedures into the local community.

Figure 3.20: The innovative space: players and linkages.



SOURCE: (CORNETT, 2006)

In the regional policy, the innovation constitutes a fundamental instrument and it is considered to be one of the main drivers for economic growth. In this context, relationships and then partnerships between public and private actors are necessary. (Cornett, 2006)

It can be said that when the various actors inside the system take part in action, they define a partnership. A partnership can be defined as a regional framework based on voluntary commitment to co-operate to start and promote special initiatives. In this case, a partnership is settled inside a region and in specific context, but, as shown in Figure 3.20, it can involve partners placed in other regions.

Innovation and knowledge dissemination of research results are the main drivers behind economic development within a company and the regional environment. Here, it can be usually identified a problem: the contradiction between innovation as societal demand for accessibility of knowledge and private good. A partnership becomes a forum for knowledge exchange to obtain a benefit for the two or more partners. (Cornett, 2006)

### 3.3.1 The Regional policy

The regional strategy has a crucial role on the success of the national system. As consequence of this relation between regional and national level, the capacity for the regions to implement a coherent and effective plan for the territory, it becomes fundamental.

The regional autonomy assumes an important role for the impact on the regional governance within innovation so, also for the regional innovation policy and strategy, and the resulting success of the national innovation system.

Many researchers argue about the degree of regional autonomy and its implications on regional innovation policy. If the regional autonomy is high, the regions can tailor and control policies in relation to the regional context. The national policies cannot provide a small-scale support because their aim is to support the whole economy for a general innovation development. (Baier, Kroll, & Zenker, 2013)

From this perspective, in 2007, Denmark introduced a structural reform for the decentralisation and the strengthening of the decentralised public sector.

Previous analysis had revealed that many of the administrative units were too small and were not able to handle the assigned tasks and the counties, the regional entities, were not able to plan efficiently a strategy.

So, the government decided to reduce the 271 municipalities to 98 and establish new 5 regions substituting the 14 counties.

As a result of the reform, there was a transfer of competences from the national government to the lower level such as the municipalities, now responsible for more tasks, public services and obligations.

Moreover, the regions are now responsible for the regional innovation policy and business development to stimulate the creation of new firms. From the functional point of view, the new regions share the responsibilities with the ministry and the new enlarged municipalities.

This reform was the starting point to a decentralisation process of tasks and administration to the local levels. This process is still active because the government has recently introduced a new reform to transfer regional responsibilities to the municipalities. (Jan Hendeliowitz, 2008)

The process is also defined as deconcentration so, *“the management of tasks is to a great extent subject to the central government’s priorities and regulations, but it is implemented by local levels”*(Jan Hendeliowitz, 2008).

The government believes that the decentralisation of the public sector is strategic because it brings the public sector and the political decision-making close to the citizens. Moreover, the decentralisation represents a more flexible approach to manage efficiently tasks and responsibilities. If the state has to control many public entities, it needs more regulation and bureaucratization that make the system less flexible. (Jan Hendeliowitz, 2008)

On the regional level the growth forums, created in 2007, become the fundamental point of the public policy and they include actors from knowledge and research institutions, public institutions and the business and industry sector. The growth forums reflect the above regional Triple Helix model. Since 2007, for the regions, it is mandatory to implement and plan a regional growth policy and invest financial resources on programs and projects. Before it was on voluntary based. More details about the regional growth forums will be presented in the following paragraph.

An example of fund is the High Technology Fund that dedicates the 25% of funds just for the Small and Medium Enterprises. This is a core initiative because it is recognised the importance of SMEs that constitute an important part of the Danish economic structure. According to the issues discussed in the introduction, in the regional development context, the process innovation is more important than product innovation because of the skills developed and the positive spin offs for the creation of human capital.

The advisory system focuses his attention on the knowledge diffusion system within and between organisations. Instead, in the business system, the knowledge diffusion is analysed horizontally between individual firms and vertically in the production systems. Even if the innovation policy is regulated by the national government, the regional and local communities are fully involved in the implementation of policies especially for what concerns SME's innovation. (Cornett, 2006)

The table below (Table 3.11) provides an overview of the supply side players and the main functions and relationships inside the system. (Cornett, 2006)

*Table 3.11: Functions and units in the danish system of innovation*

	<b>Administration;</b> Policy & financial bodies)	<b>Implementation:</b> Tools & programs	<b>Knowledge institutions:</b> Research and graduate education
<b>Local/regional</b>	Regions (until 2007 counties) & municipalities	Previously TIC, now part of regional business service system	Universities and R&D institutes, University colleges
<b>National</b>	Ministries and Governmental agencies	GTS, (approved technology service institutes)  Technological Institutes Consultants	Universities and R&D institutes, University colleges
<b>Spatial/supranational</b>	EU International Agencies	6 & 7th framework program  The Northern Dimension Working Group on Innovation (www.ndinno.net)	Universities and R&D institutes, University colleges

SOURCE:(CORNETT, 2006)

There are several initiatives and programs dedicated to SMEs as can be seen on Table 3.12.

Many initiatives are focused on supporting the innovation and entrepreneurship because they are recognised as the main driver for the growth. In particular, the new law for knowledge transfer between public institutions was issued in 2004 to favour the knowledge and technology transfer and stimulate the dissemination in entire system. (Cornett, 2006)

*Table 3.12: Selected Growth and Innovation Initiatives since 2003.*

<b>Topic</b>	<b>Programme</b>
Entrepreneurship/start up	Reform of business service (2004) Start-up loans (2004)
Employment	New joint jobcentres for unemployment service (2004)
Entrepreneurship/start up	Tutoring programs and guidance for entrepreneurship in primary schools (2004) Founding of IDEA, International Danish Entrepreneurship Academy (2004)
Research and Innovation	High Tech Foundation (2004) New law for knowledge transfer between public R&D institutions (2004)
Regional growth	Knowledge moves out – the road to high-tech regions (2005) 5 Regional Growth Forums (from 2007)
Virtual adviser database	Innovative entrepreneurs at the universities' program (2005) Idea lab (2005) Revision of Business development law (2005)

**Source:** Ministry of Economic and Business 2004.

SOURCE: (CORNETT, 2006)

In general, the principal aim is to build the bridge to connect knowledge in the innovative space introduce before and solve the problems that characterise some geographical regions (marginal areas) and creating new opportunities.

On the other side, the other players such as chamber of commerce and business organisations have to incentive the creation of cooperation and relationships and the knowledge institutions have to exploit the public funds crating projects, opportunities and collect extra money from external sources.

The Figure below (Figure 3.21) presents the more important elements in a regional strategy that are necessary to develop and implement a policy able to improve the regional growth. (Cornett, 2006)

It must be kept in mind that the regional innovation and growth need to be analysed keeping in consideration the regional and international economic context because all the factors are interconnected.

Figure 3.21: From innovation to growth.

Level /Measures	Innovation	Transfer of knowledge dissemination	Adaptation/implementatation	External growth environment
EU/supranational	x	↓ →	↘	↓
National	x	↓ →	↘	↓
Regional/local	x	→	→	<i>Regional growth</i>

SOURCE: (CORNETT, 2006)

In order to achieve a regional development and growth, Denmark, as well as other European countries, has to tailor strategies and policies considering their characteristics and exploiting the regional peculiarities.

To enforce and strengthen all four aspects of innovation, it is necessary to stimulate the relationships and linkages in the innovative space suggested by the Triple Helix model trying to support and develop a profitable exchange between universities and companies. (Cornett, 2006)

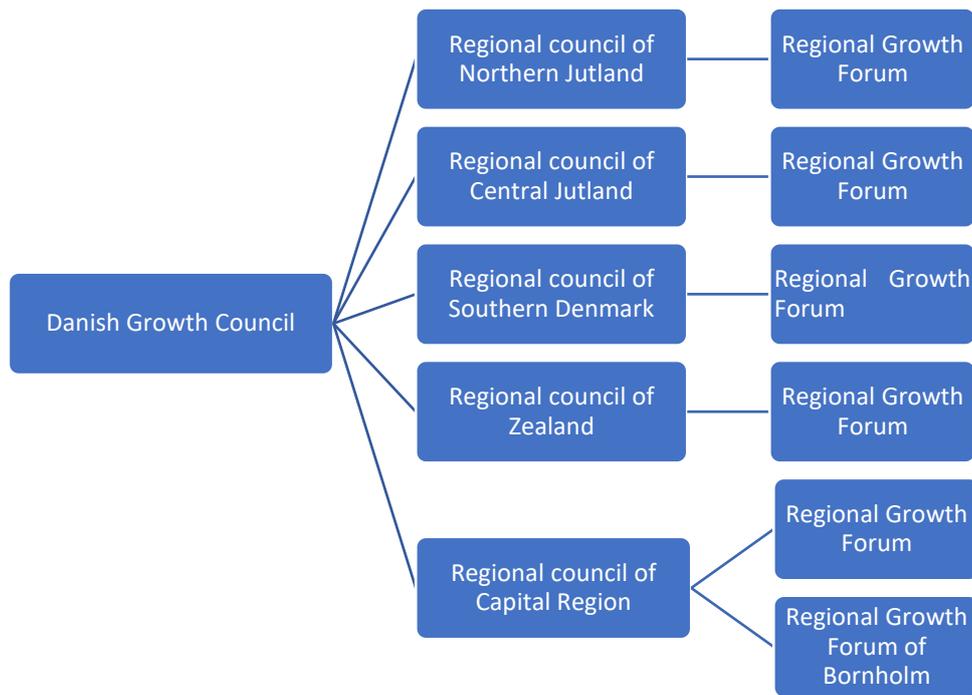
### 3.3.1.1 The Regional Growth Forums

The Regional Growth Forums, as specified above, were established in 2007 in all the five Danish regions: Northern Jutland, Central Jutland, Southern Denmark, Zealand and Capital Region. Moreover, it was created one additional Growth Forum in the regional community of Bornholm.

They have an important role inside the regional economic environment indeed, they are responsible for the creation and the maintenance of growth in region and, as

consequence, of the entire country. Each Growth Forum is composed by twenty members appointed by the Regional Councils and elected every four years. The chairman of each Growth Forum has a seat in the Danish Growth Council that is responsible to ensure cohesion between the regional and national policy. (OECD, 2009)

Figure 3.22: Structure of Danish Growth Organisations.



SOURCE: AUTHOR'S ELABORATION FROM OECD (OECD, 2009)

The growth Forums have three important functions:

1. Develop the Regional Development Strategy;
2. Monitor regional and local economy trends in order to understand how improve the next strategy;
3. Provide recommendations on co-financing for regional activities based Regional Development Strategy.

So, various aims can be identified:

- Improve the framework conditions for growth and the cross-border collaboration;
- Promote development and employment in the region;

- Strengthen the collaboration between the different public institutions and also the relationship between private and public sector in order to improve the efforts on business development.

They stimulate the regional innovation by advising the Regional Councils on which measures and funds must be implemented to support innovation and the regional business development.

In order to reach their objectives, they collaborate with various actors of the entire innovation system such as university and research organisations, representatives from the private sector, the municipalities and labour organisations.

The Regional Growth Forums, acting as a committee, recommend the use of European and Regional Funds, but they do not provide funds by them self. (OECD, 2009)

### *3.3.1.2 Invest in Odense, a task force in the municipality: a practical case from Southern Denmark*

It is presented Invest in Odense thanks to the collaboration of Sanne Elin Vinderslev<sup>2</sup> who has allowed to understand better the role of this institution.

Everything started in 2012, when Maersk closed the plant in Odense, a lot of people within the sector were unemployed and the municipality needed to do something for the city and its citizens. They had a high unemployment rates compared to the rest of Denmark and they were not able to find jobs for the citizens. The city economy was in crisis because a big share of population was unemployed.

The City Council decided to make a core strategy for the city because they had a lot of unemployment. Until the last century, Odense had a lot of industries which have moved away for various reasons. Odense's economy was collapsed so, new growth areas were needed to get income through new companies. In the fall of 2013, the municipality decided to create a task force, Invest in Odense. It is a public organisation, is part of the municipality of Odense and it is 100% publicly founded and financed. It is a completely new institution with a new team hired to do this specific job. Everyone has an academic education, but with a different background, someone has had important role inside an

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<sup>2</sup> Sanne Elin Vinderslev is a consultant inside Invest in Odense. She takes responsibility for the service provider network.

enterprise, others have studied economics and others engineering. It is a heterogeneous team.

Invest in Odense was responsible to identify the new possible strengths for the city and it found robotics, drones and healthcare as potential areas where it could be attracted companies and built a new economy for the city. All the initiatives were developed in the local economy. It was made quite a lot market analysis to understand where the potential opportunities could be, where they have something that would be able to compete with the rest of Denmark and Europe.

These identified areas were already there in the city, for example the robotics industry was developed thirty years ago with the linear shipyard; the Maersk Foundation gave the university a new technical faculty with a new building and all the facilities needed. The university got a lot of new professors and people from the biggest Danish companies, and the city started to lay the foundations for the robotic cluster. But only in 2014 these areas started to have a strong development thanks also to the activity of Invest in Odense.

Invest in Odense is attracting companies not only from the rest of Denmark, but internationally going out into the world and focusing on the identified potential clusters. It is looking to growth and high-tech companies that will need high skilled workers, so they create jobs in the town and make revenues. It is like a cycle.

In spite of these efforts, it was hard to find jobs for some kind of candidate profiles so, it is looking into tourism and develop a tourism strategy for the city. It is trying to attract tourists, especially from China, exploiting the name of Hans Christian Andersen, but also business tourism so, organising business events in the city such as conference where the people get in contact with the city, they go out, buy foods and so on. So, it has an all-round strategy, exploiting all the potential opportunities.

We can synthesize its aims:

- Create new jobs to reduce unemployment in the city;
- Attract companies to invest in the city within the potential areas (Robotics, Drone, Health Tech and Tourism);
- Attract venture capitalists;
- Help companies to set a business in the city.

The first point is very important for the city. In fact, Invest in Odense has an ambitious goal to create 10000 private jobs in the city within 2020.

The four objectives are interconnected. It tries to pursue the aims in different ways. It organises events, conferences and other kind of events to attract potential people; when they are there, it shows what the city can offer, and it tries to convince them to invest in the city. It also travels out in the world to conferences and fairs that focus on their strategic fields. If the companies are interested, it tries to support them in different ways, supplying information about the country, how to set up the business, how to get employees. Moreover, it offers a service called Network Provider which provides services such as banks, lawyer, accountants and so on. This because for companies coming to a new country is not easy, especially for Small and Medium Enterprises, they need the right network to get involved. The institution cannot support financially the companies.

Now the team of Invest in Odense is already working to develop the next strategy, it is identifying new potential areas, maybe correlated to its current focus, and doing market analysis to understand better which path take.

The organisation collaborates a lot with the university especially within the drones because it is thanks to the university that the drone cluster is developed. The University introduced the first master about drones in Europe and now there are investments in the airport and in health care sector. This strong collaboration with the Southern University of Denmark (SDU) has led to the airport becoming the national test place for drones and this has positive consequences on attracting international companies to the city because they have unique possibilities to fly in the airport and test their products.

It works closely to other institutions such as Hospital and regions, and this close interaction makes strong synergies with positive consequences to the whole system where all the actors try to operate following the Triple Helix model.

The Hospital, controlled by the region, is a University Hospital and it is the second biggest one in the region. Here, if a company within Healthcare comes to Odense, it has the possibility to test the healthcare solution to understand if it is safe and usable on patients. Within this sector, there is a strong collaboration with Japan because they have a lot of technologies, they have an aging population and they want to work with healthcare technology. So, their companies want to come here to test their knowledge

at the Hospital with real patients because in Japan it is really hard to obtain the permit to do it. On the other side, Danish companies can go there for their aims.

Moreover, there are a lot of delegations such as city governments, groups of companies from Korea, Japan; China, United States, Holland and Spain that come to Denmark to learn about how they are doing things.

Invest in Odense collaborates with both SMEs and big companies, but the largest focus is on small and medium companies because their expansion is rapid, especially within this industry. And this is not because Denmark has a high percentage of SMEs because the institution looks internationally not only on the local environment. Looking at the big ones, it takes a really long time so, it prefers the faster small companies that need more this kind of support. Anyway, it has worked with Facebook who has built a data center there in Odense.

It has an important role in the city economy, but it has to face various obstacles during the implementation of its strategy. The city government normally wants to do a little bit of everything, to help everyone, but this is not possible, Invest in Odense thinks that it is better to focus on just some areas. So, a lot of businesses and industries are excluded from its action because it concentrates its effort on the highest potential sectors, and then help other industries. It takes years to demonstrate that this is the right strategy, but fortunately the city council is understanding and looking its positive results.

Another obstacle is the legislation that sometimes limits what it can do so, it loses a lot of time to check legal stuff and understand if it can or not. This is perceived from the national government who wants to make it simpler so, it will be simpler for private companies too to get this kind of help from Invest in Odense.

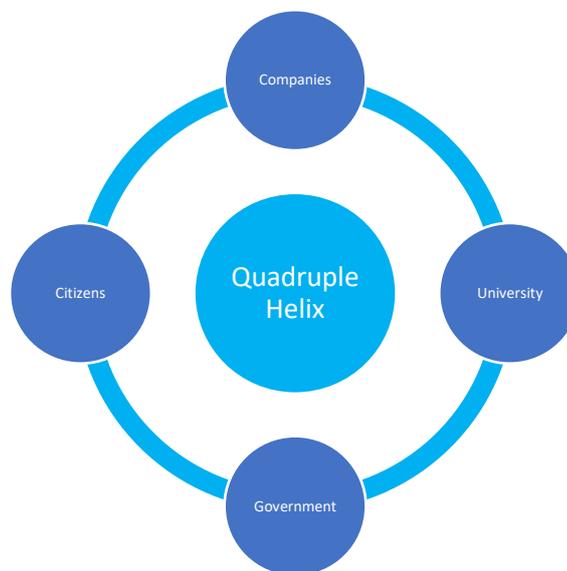
Moreover, sometimes it happens that it wants to develop a strategy but, it has not the legal authority to do it because it is competence of the region. It collaborates actively with the region, but the latter has to help every city in the whole region, it cannot be focus on just Southern Denmark. Anyway, the government is working on a new legislation within this topic, it is coming next year, and it will simplify the relationship between the two level, decreasing the responsibility for the region and increase those for the municipalities that are closer to the local territory.

Studies show that for a specific area you need to be close to industries and companies to help them to grow. The municipality pays the region to do it for them, but then it does

not have so much influence on the regional strategies so, the municipalities lose a lot of opportunities. It can be possible that it is the right solution because fifteen years ago the government has reduced the number of regions, but now for them it is too difficult to face each challenge in the territory. For example, Odense has different problems respect to other part of Funen or the area close to the German border. Maybe with this simplification, the municipalities will have more power to focus on their specific territory. On the other hand, small municipalities will receive less funds so, they will not have the same possibilities to create and develop important activities and projects.

Now, Invest in Odense is investing on citizens, considered the new element of the Helix model (Figure 4.23). It is sure that the citizen involvement can be crucial for several aspects such as the improvement of services and also products of companies. It is not an easy task because its focus is on business so, it uses a specific communication. The citizen involvement needs another type of communication and it is not easy to develop the right strategy to do it. Anyway, it has created a specific department that focuses on the citizen.

*Figure 3.23: Quadruple Helix*



SOURCE: AUTHOR'S ELABORATION

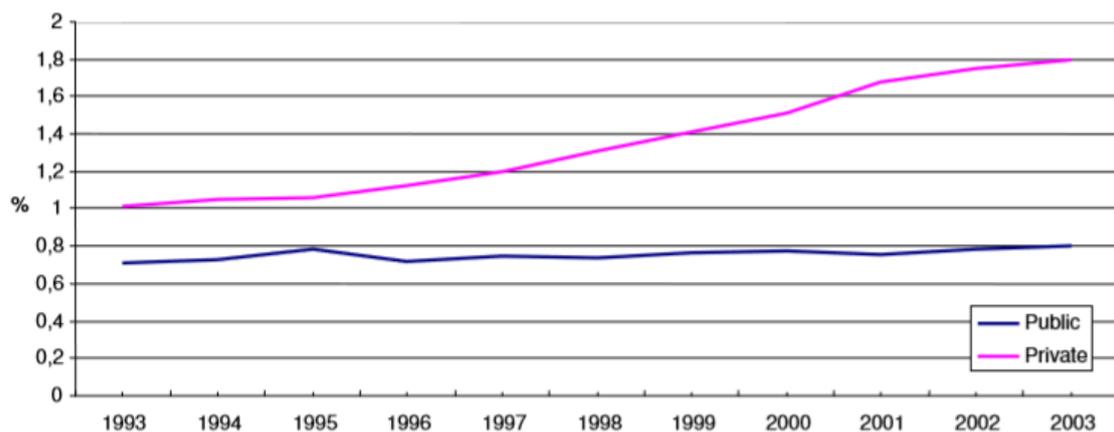
## 4 Research and higher education funding system

### 4.1 Public and Private Expenditure on R&D

Denmark is one of the European Countries that invest more in Research and Development and this is one of the reasons why it is on the top position for what concerns innovation.

The Figure 4.1 shows the R&D expenditure for the public and private sectors during the period 1993-2003. As can be easily seen, the most increment was due to the private sector that increased investments from 1% in 1993 to 1.8% in 2003. In particular, the private expenditure started to increase faster in 1996. In 2002, the total expenditure was 35 billion DKK and one year later was increased to 36.5 billion DKK corresponding to 2.61% of the total GDP in 2003. Denmark, as other European countries, increased the effort in R&D investment to reach the 3% of the GDP expenditure in order to respect what decided during the Barcelona Summit in 2002. (Danish National Research Foundation, 2005)

Figure 4.1: R&D Expenditure in percent of GDP (1993-2003).



SOURCE: (Danish National Research Foundation, 2005)

The public expenditure was worth approximately 11.2 billion DKK in 2003 and it was responsible of the 0.8% of the total Denmark's GDP. This data underline the importance of the private expenditure that represents an important contribution to R&D effort of

the country. Moreover, the public expenditure looks like stable during the years without any reduction. (Danish National Research Foundation, 2005)

On the graph below (Figure 4.2) it can be seen the total percentage (public and private) until nowadays. (World Bank, 2018)

Figure 4.2: Private and Public R&D expenditure in percent of GDP (1997-2015).



SOURCE: (WORLD BANK, 2018)

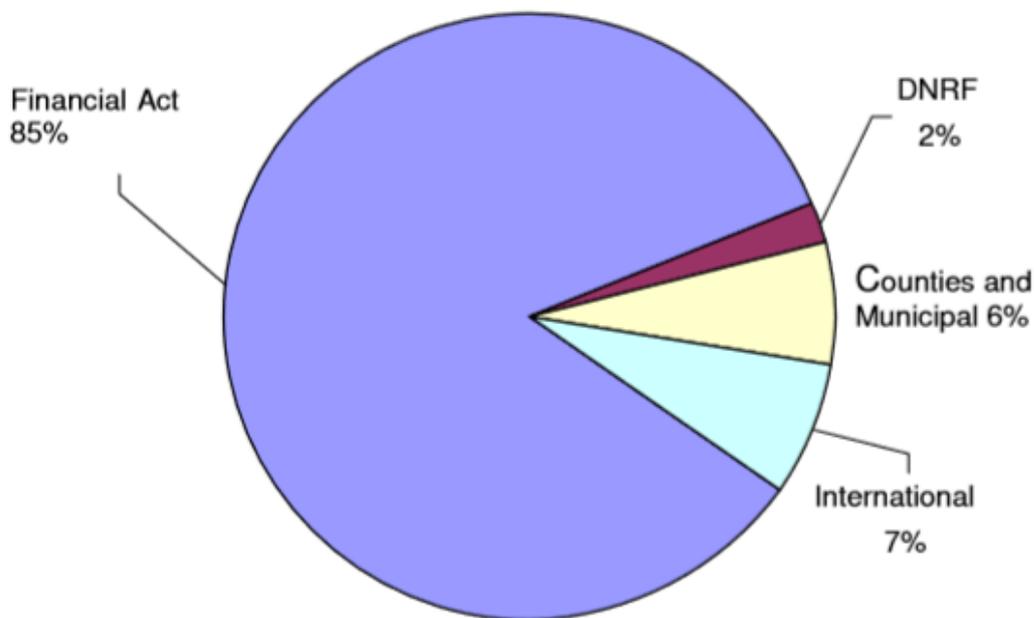
The analysis proceeds showing the different sources of the public expenditure, its sectoral distribution and how are provided to the different scientific areas. Even if the data are collected in 2003, the study is still valid and gives a clear representation of R&D funds in Denmark. Today the grants are increased, but the organisation is almost the same.

In 2003, the total expenditure on R&D amounts to 11.8 billion DKK. As the graph below (Figure 4.3) shows, the vast majority are provided through the Financial Act that counts for the 85% of the total expenditure so, it has worth of 9.2-9.5 billion DKK. A small share is granted by European Union through various framework programmes, the counties and municipalities and the Danish National Research Foundation (DNRF). The last institutions contributes with small amounts if compared with the Financial Act indeed, their grants amount to 260 million DKK. (Danish National Research Foundation, 2005)

#### 4.1.1 Public R%D funds

The funds derived from the Financial Act are distributed by the various ministries but, in 2003, the Ministry of Science Technology and Innovation was responsible for the 59% of the total funds of the Financial Act because this ministry has competence on the universities and research institutions (Figure 4.3). (Danish National Research Foundation, 2005)

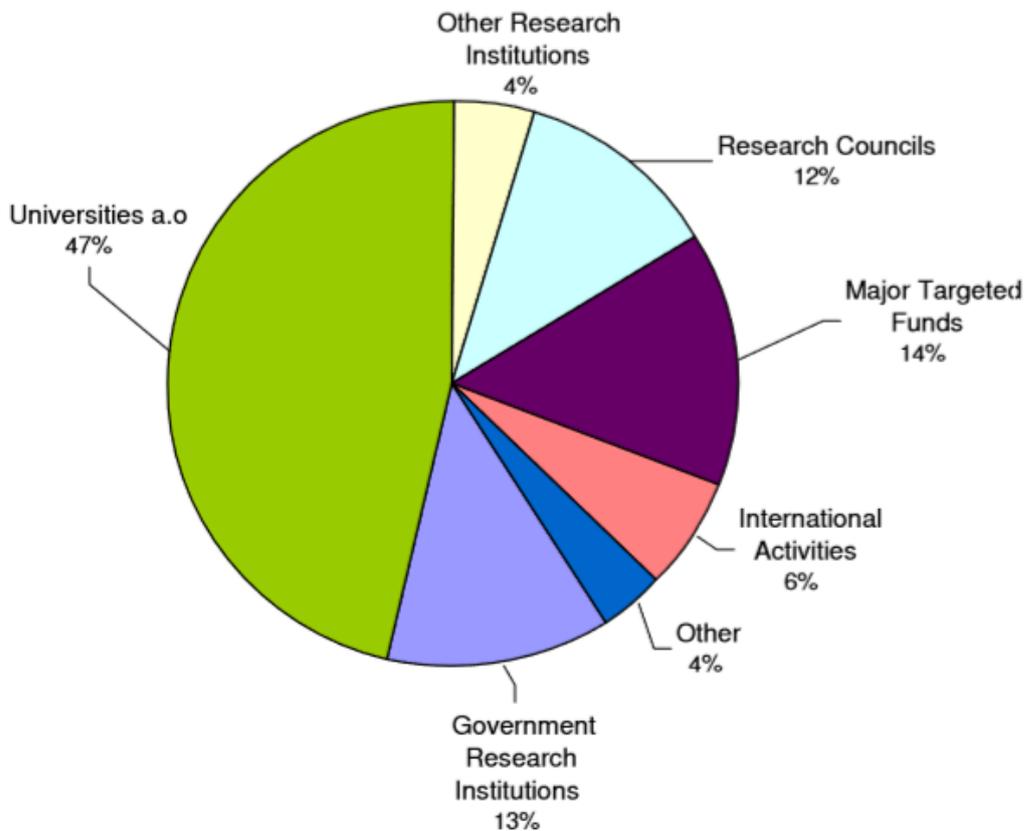
Figure 4.3: Public Expenditure on R&D distributed on Financial Source, 2003.



SOURCE: (Danish National Research Foundation, 2005)

The next analysis concerns the sectorial distribution of R&D grants provided by the government through the Financial Act in 2003 (Figure 4.4). The Universities and Institutions of higher Education are the main beneficiaries of the Financial Act. They administered the 47% so, about 4.3 billion DKK. Then, the Government Research Institutions received the 13%, while the Research Councils obtained 12% that corresponds to 1.1 billion DKK. (Danish National Research Foundation, 2005)

Figure 4.4: Sectoral Distribution of R&D grants from the Financial Act, 2003.

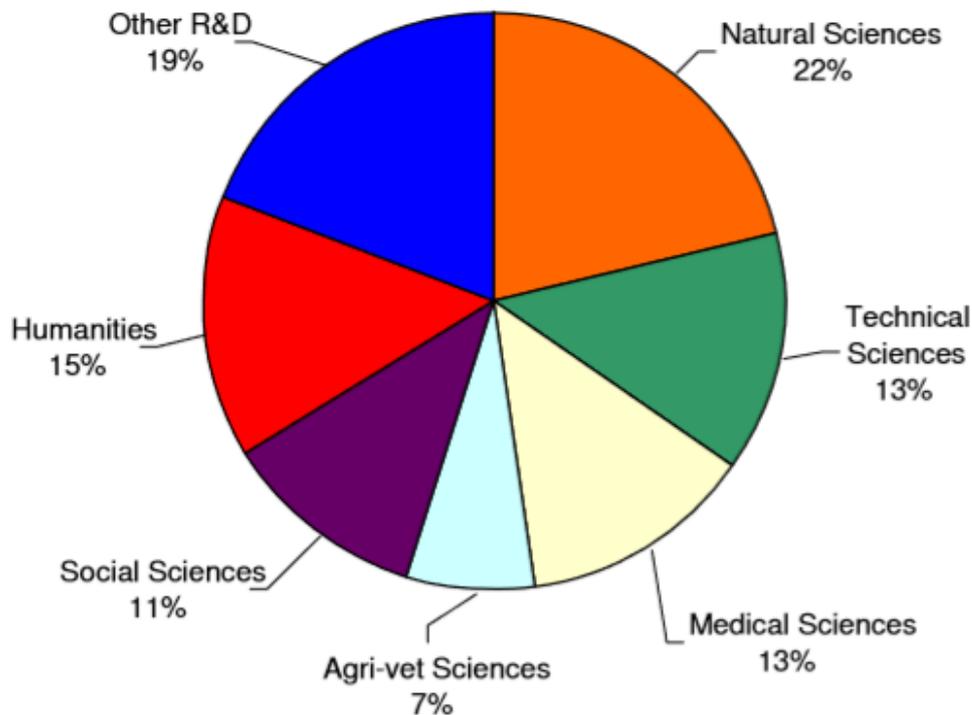


SOURCE: (Danish National Research Foundation, 2005)

The rest was administered by Other Research Institutions, International Activities and Major Targeted Funds. (Danish National Research Foundation, 2005)

The 60-65% (6 billion DKK) was dedicated to basic research such as research at the universities, while the rest was invested in applied research and development activities. Moreover, it is interesting to analyse the grants distribution for the Basic Research to the various scientific areas (Figure 4.5). First, the total amount dedicated to basic research was about 6 billion DKK in 2003. Natural Sciences was the largest beneficiary of the Financial Act grants with 22% of funds followed by humanities with the 15%. Technical Sciences, Medial Sciences and Social Science received about the 12%. Agriculture Veterinarian Sciences receive only the 7%. The rest was invested in other R&D activities such as PH.D.-training, interdisciplinary research projects and research libraries. (Danish National Research Foundation, 2005)

Figure 4.5: Distribution of Financial Act Grants for Basic Research according to Scientific Area, 2003.



SOURCE: (Danish National Research Foundation, 2005)

#### 4.1.2 Private R&D expenditure

Speaking about the private investments on Research and Development, in 2003, the 86% of the total private expenditure was invested within own companies so, just a small share is provided for government research institutes and higher education institutions. (Danish National Research Foundation, 2005)

#### 4.2 Main Characteristics of the Research Funding System

In Denmark the Research Funding System is continuously under development in order to improve it and exploit better the resources.

The existing research funding system is based on two main sources: the basic grants and the external grants resulting in a two-tier system.

The first component is dedicated to the budget security of institutions and enables them to plan in long term perspective.

The second one is the major fund source and it is based on subsidies received from EU, research councils, strategic research programs, private foundations and firms. (Schmidt, Langberg, & Aagaard, 2006)

#### 4.2.1 The first tier

The grants for basic research are allocated to institutions as a lump sum and it is calculated on an incremental basis. The institutions are completely free to use these grants without any specific constraints so, they can invest them with any research purposes.

The allocation to the institutions, in particular to Universities, is based on historical aspects and it is permanent.

The basic grants are affected by fluctuations in condition of the Ministry. This takes in consideration the annual Finance Act presented by the Government including the general demands for more savings and higher efficiencies.

Then the new research grants are distributed taking in consideration the models relying on their activities analysed through various parameters. So, inside each research institution such as the universities, there is a re-allocation of the resources based on activities to create a model supported by incentives.

Moreover, the 2% usually is retained for improvements about the productivity. This share is allocated via the so called "50-40-10" model. So, the 50% for educational grants, the 40% for subsidized research and 10% for PhD degrees. (Schmidt et al., 2006)

#### 4.2.2 The second tier

As introduced before, the second tier includes resources allocation from different institutions and also from private players such as firm or foundations. These resources are allocated for a shorter period of time for project proposals, for research activities specified by the institution providing the grants. So, the resources are allocated through competition.

The researchers, due to the insufficient basic grants, need to seek funds from the second tier where the competition is very high. (Schmidt et al., 2006)

#### 4.2.2.1 *The second-tier structure*

Five bodies constitute the research advisory and counselling system:

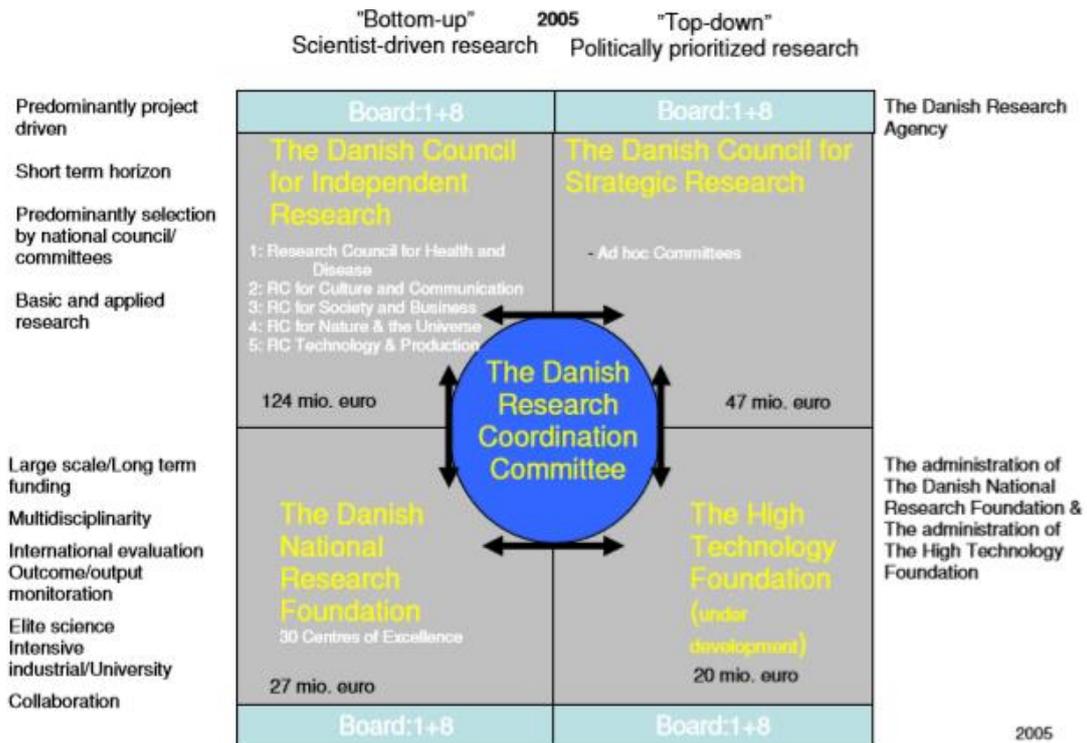
- Danish Council for Research Policy (Danmarks Forskningspolitiske Råd) – advisory board to government only.
- The Danish Council for Independent Research (Det Frie Forskningsråd)
- The Danish Council for Strategic Research Council (Det Strategiske Forskningsråd)
- The Danish National Research Foundation (Danmarks Grundforskningsfond)
- The Danish National High Technology Foundation (Højteknologifonden)

The Danish Research Coordination Committee (Koordinations Udvalget for Forskning KUF) coordinates the activities of these bodies.

The picture below (Figure 4.6) explains very well how the system works. The various organisations involved are already presented in the first part of the innovation system analysis. (Danish National Research Foundation, 2005)

This system is based on the bottom-up principle implemented by the Danish Councils for Independent Research and the Danish National Research Foundation and the top-down principle, politically prioritized funding allocations. (Danish National Research Foundation, 2005)

Figure 4.6: Second tier system.



SOURCE: (Danish National Research Foundation, 2005)

### 4.3 Research Institutions in Denmark

In Denmark there are different research performing institutions:

- Universities and other higher education institutions under the Ministry of Science Technology and Innovation.
- Government research institutions controlled by different ministries.
- Private companies

(Danish National Research Foundation, 2005)

#### 4.3.1 Universities

In Denmark there are five multi faculties universities, two one faculty universities specialised in technical programs and the Business School of Copenhagen with two faculties in business and languages. All of them offer education programs and conduct research projects. (Schmidt et al., 2006)

There were twelve universities until some years ago but, they were reduced to eight through merger processes to optimise the resources, strengthen education and research and improve their competitiveness with an international perspective.

Table 4.1: Danish Universities 2004/2005.

	Hum.	Soc.	Tec./ Nat.	Health	Students	PhDs	Researchers	Founded
University of Copenhagen	•	•	•	•	32819	1339	2.298	1479
University of Aarhus	•	•	•	•	23343	820	1.608	1928
University of Southern Denmark	•	•	•	•	15809	416	879	1966
Roskilde University	•	•	•		8978	208	507	1972
Aalborg University	•	•	•		13638	564	1.154	1974
Technical University of Denmark			•		6274	673	1.435	1829
The Royal Veterinary & Agricultural University			•		3117	391	968	1858
Copenhagen Business School	•	•			11647	176	208	1917
The Aarhus School of Business	•	•			5522	65	457	1939
The Royal Danish School of Pharmacy			•		1183	108	233	1892
The Danish University of Education	•				2728	88	230	2000
IT University of Copenhagen			•		1432	46	97	2003

SOURCE: (SCHMIDT ET AL., 2006)

The universities are self-governing, and they are classified as public institutions administered by the Ministry of Science Technology and Innovation, today called Ministry of Higher Education and Science.

In 2003, the government, with the University Act, specifies that the universities are responsible to carry out the research activity and provide higher education with its subject area. Moreover, the universities should have a balanced interaction between education and research activities in order to make strategic choices and manage priorities, guarantee a continuous improvement of education and research, and stimulate and increase the knowledge transfer from knowledge institutions to the

companies and the society. (Danish National Research Foundation, 2005; Schmidt et al., 2006)

This interaction and cooperation between university and society is enhanced with the University Act because it is recognised to be an important driver for innovation. Moreover, they decide and implement for themselves the study programmes keeping in consideration new capabilities demand. They are also responsible for the research programmes. The study and research programs are approved by the ministry.

As a result of the University Act, the structure is composed by a Board, rector, academic councils, Dean of faculties and the various department (or institutes).

The board is represented by external members and others coming from the scientific and technical-administrative staff, PhD students and students. The board decides the guidelines for its long-term activities, approves the budget and statute proposals.

A rector is elected every four years among the professors and associate professors who hold a full-time position, by the staff and also the students of the university.

The academic councils are constituted for the university and for each faculty. They have the role to advise the rector about the distribution of financial resources for education and research. Moreover, they are involved in the composition of the panels responsible for the evaluation of the scientific positions and for awarding scientific degrees.

Research activities are placed in the departments. The person responsible for the department should manage the institute, plan and allocate assignments. The staff carries out research activities within the strategic areas, but it can perform additional tasks assigned by the head of the department. (Danish National Research Foundation, 2005)

#### *4.3.1.1 Funding System*

The universities receive different funds depending the final purpose: research and teaching.

The teaching activities are supported by funds provided by the Ministry of Education. These grants are provided through a taximeter system so, the funds depend on the number of students who pass their exams. The taximeter system is based on a unit cost principle, so the university receive a specific amount for each student who passes an

exam. On the contrary, the institution does not receive funds for the students who don't pass or do not take exams. In the positive case, the amount depends on various factors, for example the area of study, the cost of education (equipment, etc), administration and building costs and training costs if they exist.

The government, in particular the Ministry of Education, adjusts every year the taximeter system in order to obtain the balance of the annual ministry budget.

The universities are free to move the funds for various purposes because they are self-governing. Anyway, the institutions usually distribute the funds according to the strategy program and internal principles.

Moreover, all young Danes when they become eighteen, they are entitled to public support system for education through grants depending on their income. These grants are very generous indeed, in 2006, were app. 650 Euros per month. This works like an incentive to continue to study and invest in own education as an investment for the future. In addition, it gives the possibility to study to everyone, also to people who haven't economic possibilities.

The research activities are supported by the grants introduced before and granted by the two-tier systems, the basic and the external grants.

On the table below Figure 4.2, it can be seen how much the universities have received in 2004. It is made the distinction between basic and external grants in million DKK depending on scientific areas. Natural sciences and health sciences received a high amount of grants if compared to other areas. These are considered two strategic sectors for Denmark's growth.(Schmidt et al., 2006)

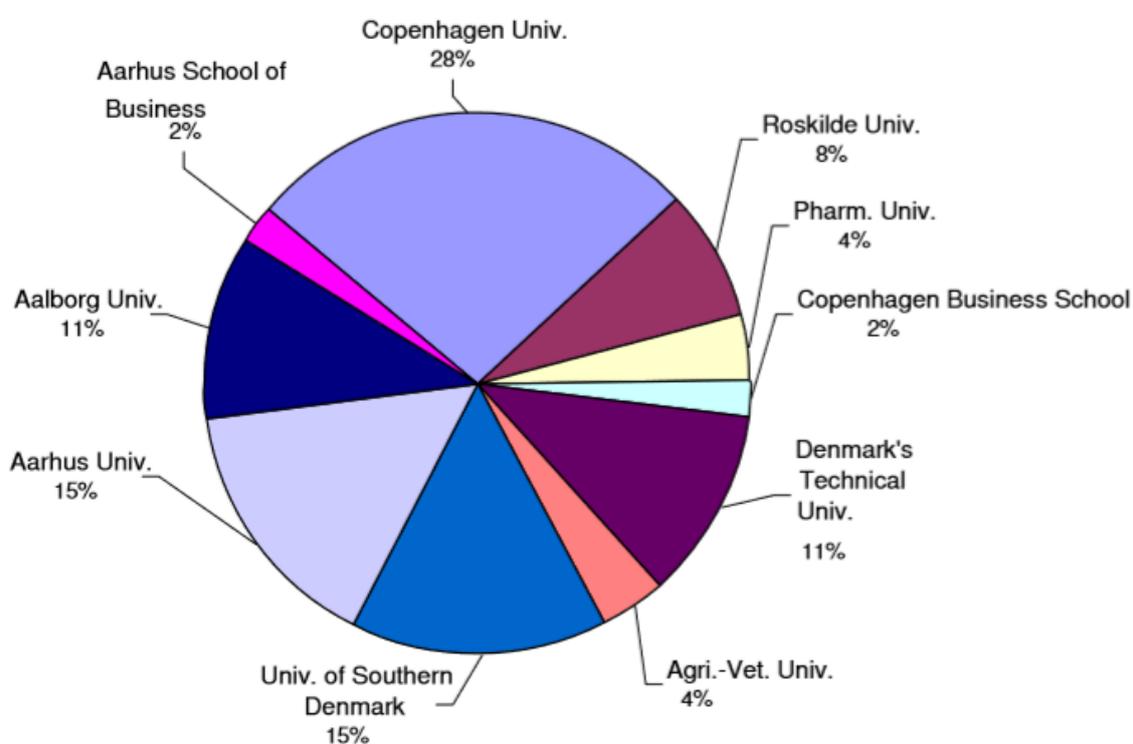
*Table 4.2: R&D Expenditures for HEs in 2004, in million DKK.*

	Basic grants	External grants	Total	Ext.share (pct.)
Natural sciences	1.430	811	2.241	36%
Technical sciences	725	427	1.152	37%
Health sciences	1.265	1.138	2.402	47%
Agr./veterinary sciences	319	180	500	36%
Social sciences	1.055	270	1.325	20%
Humanities	1.027	265	1.291	20%
<b>Total</b>	<b>5.821</b>	<b>3.091</b>	<b>8.912</b>	<b>35%</b>

SOURCE: (SCHMIDT ET AL., 2006)

The Figure 4.7 presents the R&D expenditure distribution between the University in 2003. As can be noticed, the universities analysed were ten, but now they are eight because of some mergers. Even if this discordance, the graph it is still valid to have a clear overview about the distribution. The total expenditure amounts to 6.9 billion DKK for all the Danish University System.(Danish National Research Foundation, 2005)

Figure 4.7: Relative R&D Expenditure distribution between the ten largest Danish Universities, 2003.



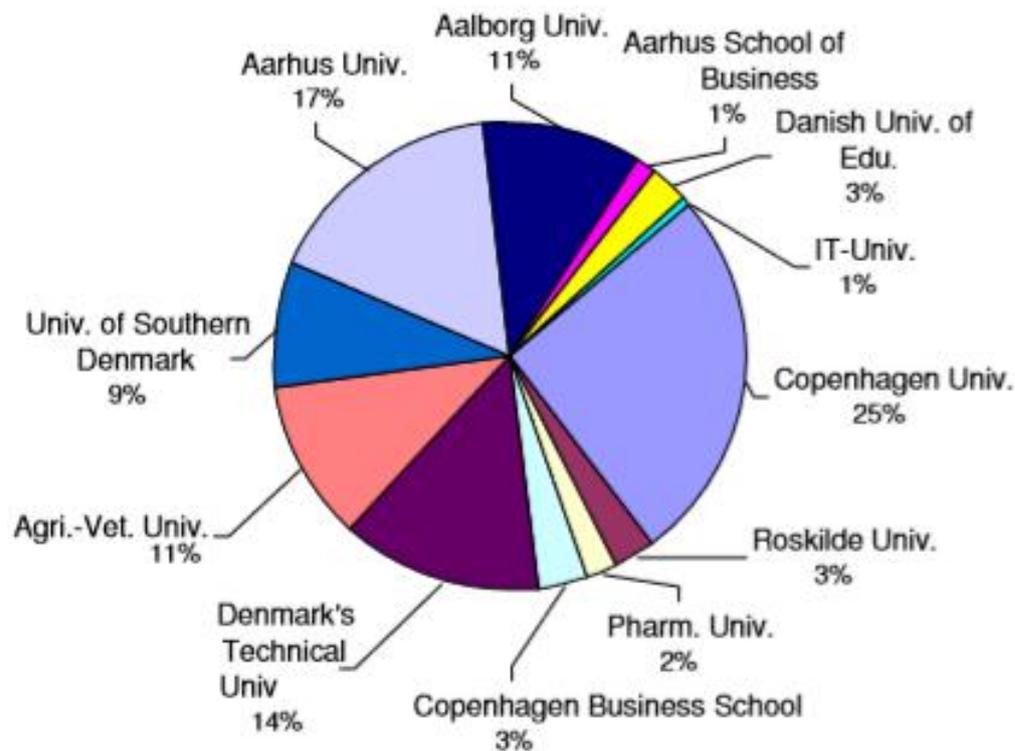
SOURCE: (Danish National Research Foundation, 2005)

Now the universities will be ranked using another method, the so called “distribution of R&D Full Time Employees (FTE – “Full Time Employed person’s work in one year”)

Looking to the Figure 4.8, it can be easily understood that more than 2/3 of the R&D FTE were distributed on the main universities (Copenhagen University, Aarhus University and DTU). Moreover, it was concentrated in the metropolitan area of Copenhagen. It held the 25% with the main university plus 16% of the Agriculture and Veterinary

University and the Pharmacy one that now they are part of the Copenhagen University. (Danish National Research Foundation, 2005)

Figure 4.8: R&D FTE at Danish Universities and Institutions of Higher Education, 2003.



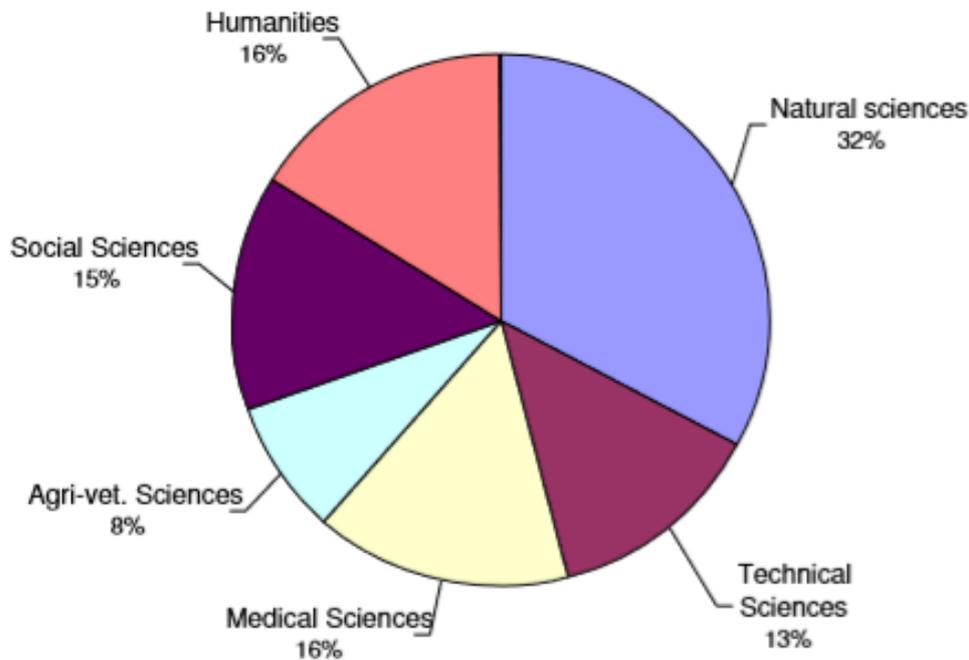
SOURCE: (Danish National Research Foundation, 2005)

The Figure 4.9 shows the R&D FTE based on scientific areas. Natural sciences held on third of the total, then Humanities and Medical Sciences the 16% both and others held the same together. This representation explains the differences in the distribution system between the scientific and technical personnel. Medical, natural sciences and agricultural-veterinary use more technical Full Time Employees because of the research activities while humanities and social science are more scientific personnel intensive. (Danish National Research Foundation, 2005)

If we have look to the Ph.D. students, we discover that they were concentrated in Natural Sciences (21%), medical sciences (21%) and technical sciences (15%). This

distribution reflects the data given on the previous graph. (Danish National Research Foundation, 2005)

Figure 4.9 R&D FTE at Institutions of Higher Education, 2003.

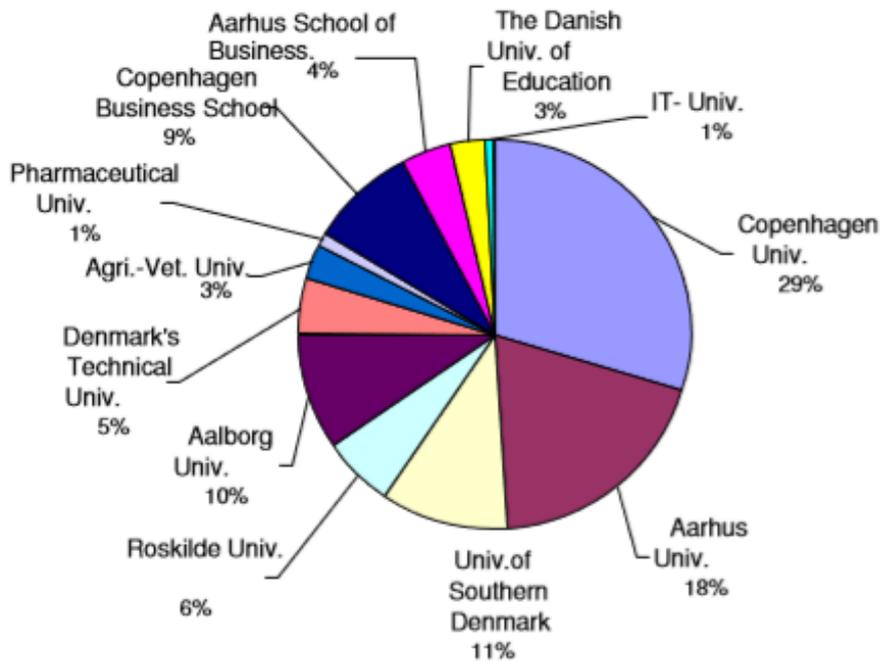


SOURCE: (Danish National Research Foundation, 2005)

The last graph (Figure 4.10) gives a representation of the student distribution among the various Universities that, as I can be noticed, reflects the dimension of each university. The majority was concentrated at the Copenhagen's Universities. However, it can be noticed how the Copenhagen University and the Business School, and Roskilde had more students if compared with R&D FTE. The opposite happened for the DTU.

In 2003, the Bachelor and Master students amounted to around 110.000 of which 2/3 were in humanities and social sciences. (Danish National Research Foundation, 2005)

Figure 4.10: Bachelor and Master Students enrolled at Danish Universities, 2003.



SOURCE: (Danish National Research Foundation, 2005)

#### 4.3.1.2 An innovation unit inside the Southern Denmark University (SDU): a practical case from Odense.

Now the analysis proceeds with a practical case of the Southern Denmark University of Odense. In particular, it focuses on a specific unit of the University, the Research Innovation Organisation (RIO) thanks to the collaboration of Esben Norgaard Flindt<sup>3</sup>, the head of an internal team of this organisation.

RIO is a real innovation unit inside the University and it represents a clear example of how the university has a crucial role on boosting innovation in the society and in business activities.

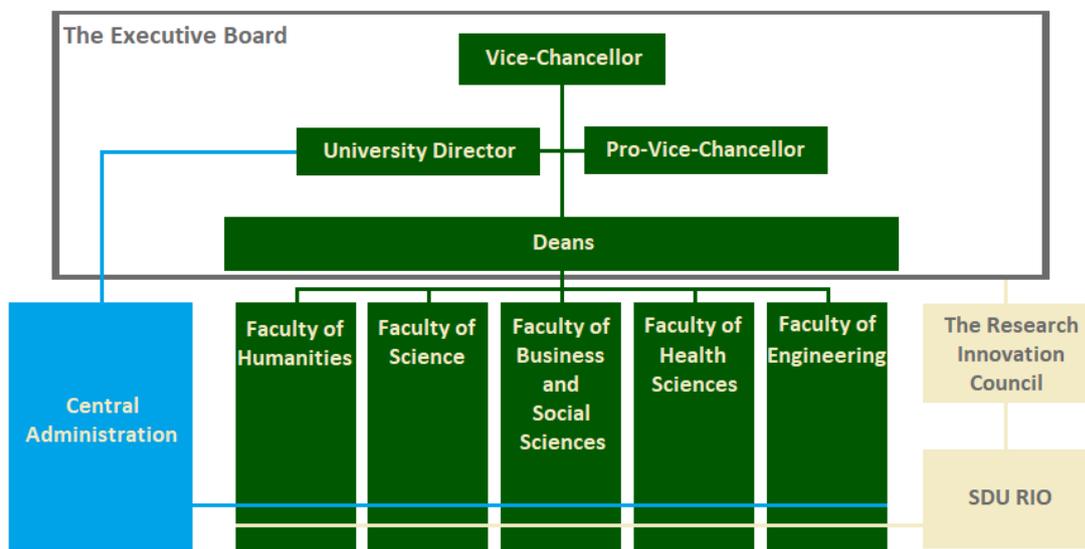
It was created just last year, on 1st February 2017, as result of an independent decision of SDU to support the strategic objectives for societal engagement. It is a new structure, but only some divisions are completely new, others were already existing. It is changed the way how they work because now they work collaborating strongly between each

<sup>3</sup> Esben Norgaard Flindt is the chief of Research Support and Policy Services, one of the eight team of Research Innovation Organisation at Southern Denmark University.

other. The creation of this new organisation, as already said, was an independent decision of the university, but it was also pushed by political pressure from the government that has increased the focus on innovation and on the impact of the university outside the academic service.

The organisation constitutes an important effort, built on a close partnership network with both SDU central offices and local faculty research support units. As it can be possible to see on the scheme below (Figure 4.11), RIO takes a side place in the university organisation, but it has a cross-role on each faculty inside the university. It is controlled by a Research Innovation Council (RI council) where there are eight members.

Figure 4.11: RIO's structure.



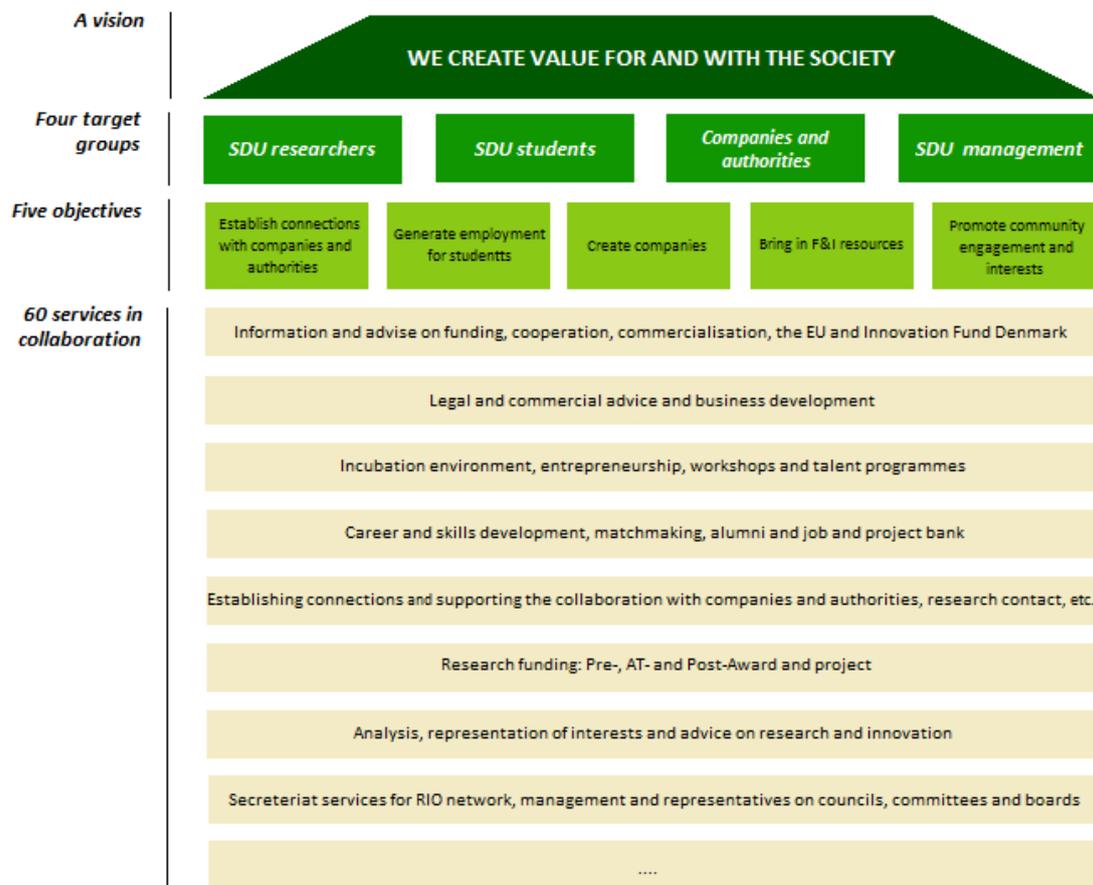
SOURCE: (Research Innovation Organisation, 2018)

RIO has a strong and important vision, it creates value for and with the society underling the relationship between the university and the society, like a bridge linking the different players.

In order to respect its vision, its activities are addressed to four main targets inside and outside the university environment:

1. SDU Researchers
2. SDU Students
3. Companies and authorities
4. SDU management

Figure 4.12: Vision, Target groups and objectives.



SOURCE: (Research Innovation Organisation, 2018)

RIO has determined 5 goals for societal engagement:

1. Build bridges with the business community
2. Ensure students employability
3. Increase the number of companies originating from SDU
4. Win research and innovation funds
5. Promote project that strengthen SDU's interests

Through its divisions that will be presented later, it is able to offer within 60 services.

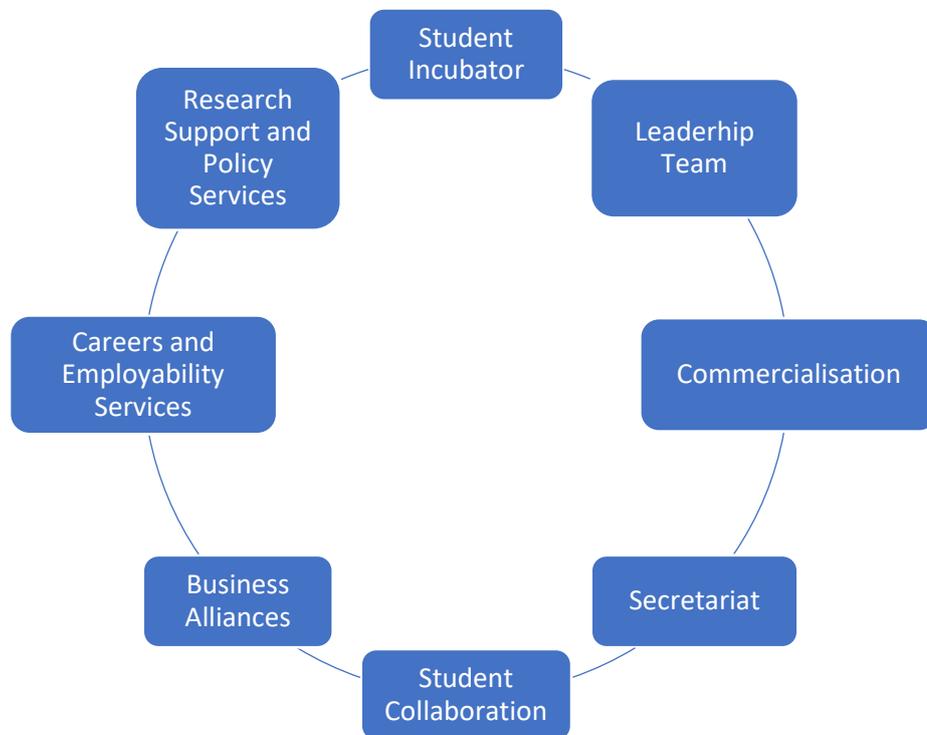
The more important are:

- Information and advice on funding, cooperation, commercialisation, EU and Innovation Fund Denmark
- Legal and commercial advice and business development
- Incubation environment, entrepreneurship, workshops and talent programmes
- Career and skills development, matchmaking, alumni, job and project bank

- Establishing connections and supporting the collaboration with companies and authorities, research contact
- Research funding
- Analysis, representation of interest and advice on research and innovation
- Secretariat services for the RIO network, management and representatives on councils, committees and boards.

Rio is an innovation unit all around, covering various aspects of the innovation and entrepreneurship eco-system.

Figure 4.13: RIO's internal teams.

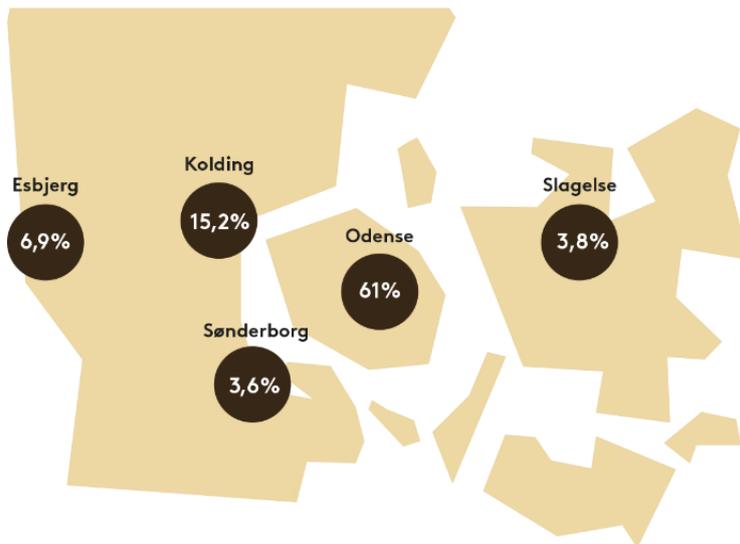


SOURCE: AUTHOR'S ELABORATION

Now the analysis moves to the eight teams that consist the organisation. As explained before, some divisions were already existing, but they were been merged into a unique organisation. The Figure above (Figure 5.13) shows perfectly the organisation underling the structure of the unit itself, emphasizing the interaction between the divisions.

The Student Collaboration team helps to build projects for students and companies and the Careers and Employability Services team helps the students to train themselves, to pick the right educational path to get the right career.

*Figure 4.14: Guided students are affiliated with the following campus.*



SOURCE: (Research Innovation Organisation, 2017)

The figure above (Figure 5.14) shows the percentage of guided students for each specific campus. The main campus of Odense, of course, reflects the biggest share of 61% percent.

The students make a great use of SDU RIO's career guidance. The 92% of all requests from SDU's students are: occupational profile (27%), choices along the way (25%), internships and projects (20%) and feedback on applications and CV (20%).

As consequence of the major importance of the career during the study path, this service is becoming a fundamental tool for students.

Career guidance is used by students of all ages from the bachelor to the master program. The students are already thinking of their career while studying at the bachelor's degree. If it is analysed the number of requests for career guidance based on educational level, master and bachelor students are the main users of this service.

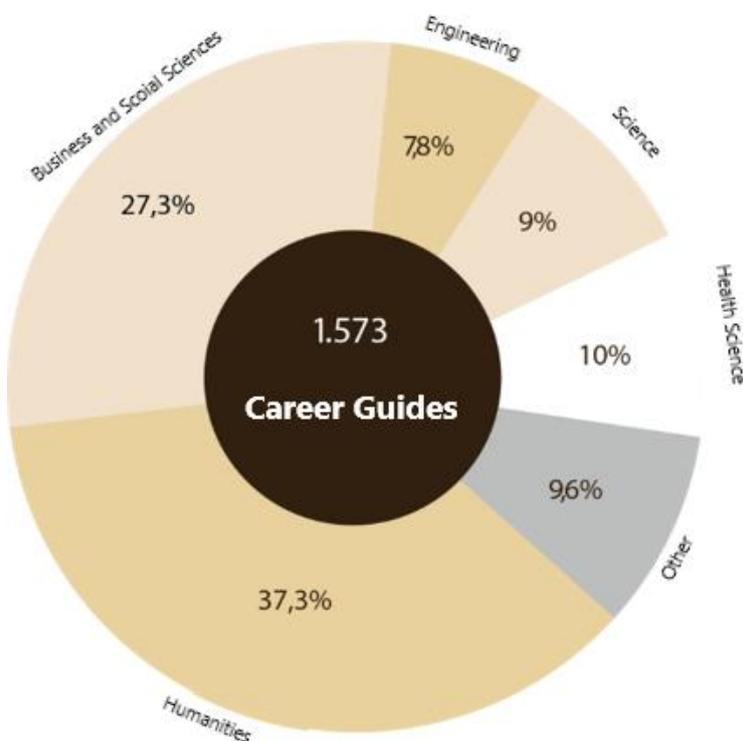
Figure 4.15: Career Guidance distribution based on educational level.



SOURCE: (Research Innovation Organisation, 2017)

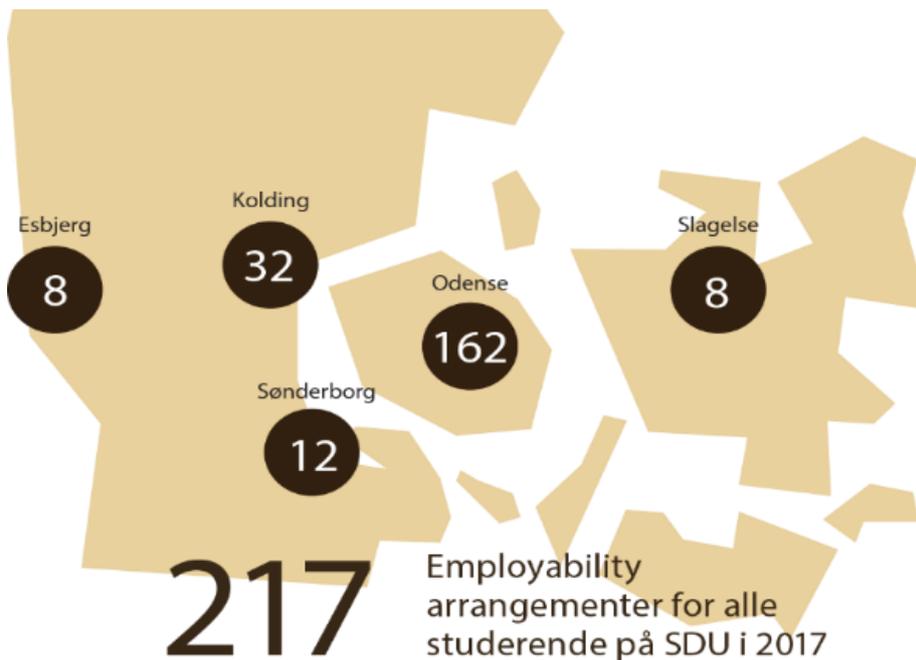
The Figure 4.16 shows the request distribution based on faculty. The students from humanities constitute the 37.3 percent of user of Career Guidance. The second position is held by the students of business and social Sciences.

Figure 4.16: Career Guidance distribution based on faculty.



SOURCE: (Research Innovation Organisation, 2017)

Figure 4.17: Employability arrangements for all students at SDU in 2017.



SOURCE: (Research Innovation Organisation, 2017)

The other faculties are only a small share compared with the first two.

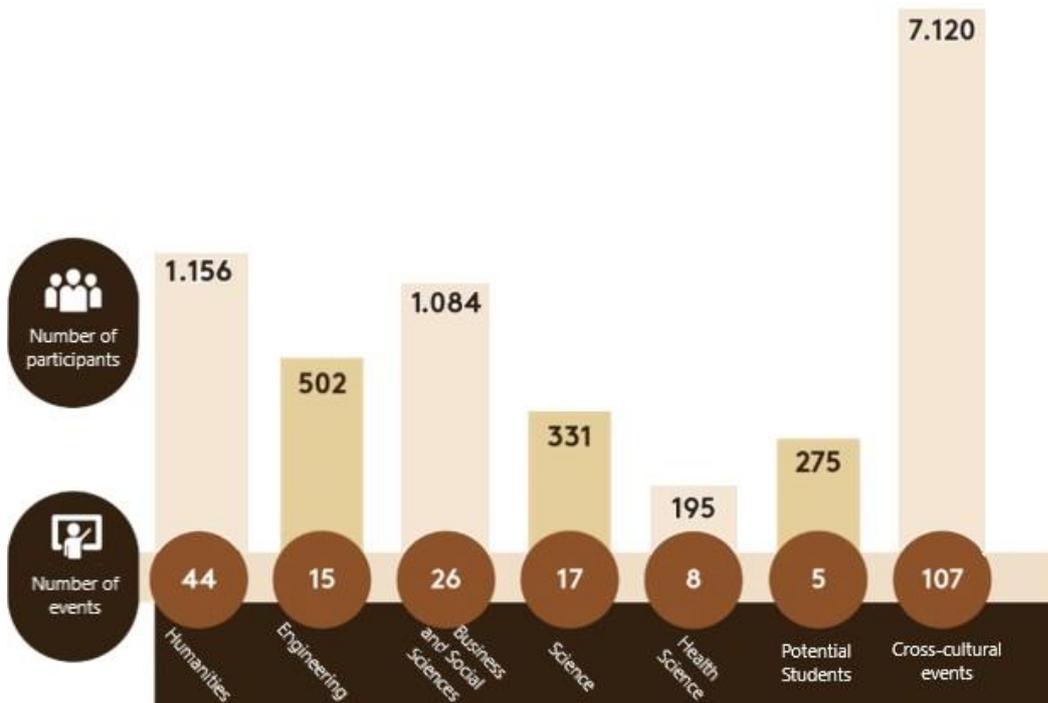
SDU has implemented a Career Management Skills (CMS) course that is now part of one or more courses at all five faculties.

The students will work on their personal career thinking about its development. It aims to allow students to think about their career while they are still students in order to be better prepared for academic and employment choice when they will be graduated.

In addition to the 107 career events for all students across the five faculties, SDU RIO also held 110 events targeted students at each faculty as it can be seen on the Figure 4.18. The faculty of Humanities and Business and Social Sciences counts respectively for 44 and 26 events.

The events have been distributed in all five cities.

Figure 4.18: Events and participants based on faculty.



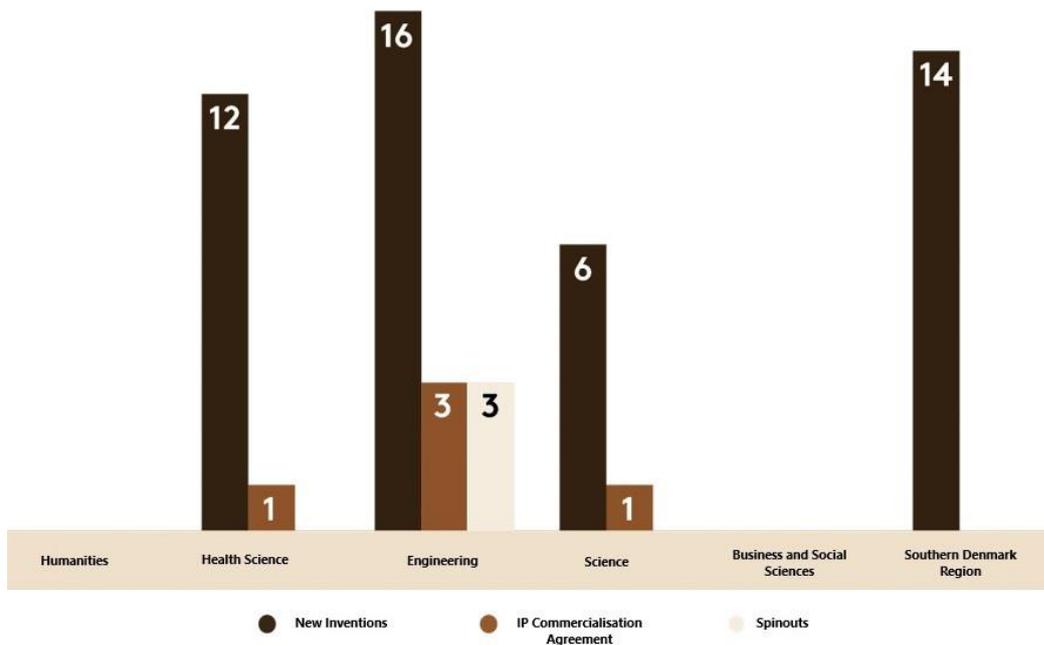
SOURCE: (Research Innovation Organisation, 2017)

There is also a Student Incubator, recently created and it will be analysed later in more detail.

The Commercialisation team tests inventions and patents, and it helps the researchers that did these inventions to develop and sell them off to not academic world.

As shown in the figure below (Figure 4.19), in 2017, there are 36 reports of new inventions; the number is on a par with recent years. Some inventions can count on several faculties. Therefore, the sum in the table exceeds the 36 reports.

Figure 4.19: Inventions, IP Commercialisation Agreement and Spinouts.



SOURCE: (Research Innovation Organisation, 2017)

There are several business scouts who go out and talk with researchers and help them to identify an idea to be patented. Then, after an evaluation, they know if it is patentable or it is already patented by other people.

Moreover, the university supports financially the researchers, it pays the expenses, for this reason the commercialisation team, in collaboration with the legal team, decide if patent or not an idea because there are not so many funds.

The Business Alliances team tries to work strategically building connections with companies, both to develop the company knowledge potential and to create new projects.

RIO is defined as a sort of glue between the outside and inside world. If a company has a problem can call them and try to identify researchers with the same interest in the right competencies. In the other side, when they make an application for EU funds or for Innovation Fund Denmark, they collaborate with the cluster of this region, they act as a network because it is fundamental to get new funds and develop national growth.

So, the collaboration with companies of the regions is working well even if some firms do not want to be open because they are worried to spread out knowledge outside the company. Anyway, this problem seems not existing because there are various systems

to protect contents such as secrecy agreements. University collaboration is an opportunity to exploit because if the companies work with a university group and they develop together a new technology, the company has the first right to buy the technology developed. There are many ways to collaborate and if the companies cannot pay for service, it does not represent a problem, they can apply for a fund together. It is a classic negotiation that can carry out new opportunities for both players.

In addition, they collaborate also with public institutions such as the municipality in order to avoid disruptive competition and enhance synergies.

Research Support and Policy Services provides support for funding strategy and applications, as well as, promotions, and positioning of long-term research interests, and it collaborates with the faculty research support units.

For what concerns the Research Support, it supports the faculties and individual research environments to increase external funding for research-based and innovation-related activities.

In addition to the support at-award, it offers an all-round pre-award support:

- Idea and concept development
- Networking and partner identification
- Identification of funding opportunities
- Pre-award strategic plan
- Hand-on application support
- Input for implementation and impact

It focuses on projects demanding collaboration with non-academic partners, especially larger and/or international consortia.

They apply for Danish and European Funds such as Innovation Fund Denmark analysed in the previous chapter, and EU H2020 funds.

The other part, Policy Services, carries out various tasks:

- Support researchers representing SDU in councils, committees, central network and reference groups focusing mainly on EU-relevant activities
- Support collaboration with private and public companies as well as interest organisations

- Contribute with policy and strategic analyses and briefs in prioritised fields of research with innovation focus.
- Secretariat services for the SDU RIO network, included the Research Innovation Council
- Support SDU's overall leadership with input for central themes of importance for the collaboration with ministries and public (national, regional and local) authorities.

So, RIO is unique case in Denmark and between Danish Universities because it encompasses all these activities, it does legal stuff, business alliances, knowledge commercialisation, start-up incubation. RIO is trying to put all these tasks together because there are so many links between these units. It is, of course, a big challenge because when you put things into one single box you have to co-ordinate and this costs efficiency, but it provides potential synergies. The different divisions are doing a big effort to work together like in a matrix organisation, to transform an organisational disadvantage to an advantage to be more efficient.

#### *4.3.1.3 The incubator Cortex Lab*

This paragraph explains in detail the University Incubator, its organisation and the main activities carried out. The analysis was been possible thanks to Christian Fuglsang Pedersen<sup>4</sup> who granted an interview.

SDU Cortex Lab, now called Entrepreneurship Lab, was created at the end of 2016. It is an incubator for student entrepreneurship and it tries to help out students who want to create businesses beside their studies. It offers some different kind of programs and the use of various facilities.

It was created from SDU itself in relation to its mission: “they have to give value to their close environment and they do that creating jobs and students who can get these jobs, but they also teach entrepreneurship to students”.

In Denmark, all the universities have an incubator or a structure that is similar with more or less the same programs.

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<sup>4</sup> Christian Fuglsang Pedersen is Business developer at SDU Cortex Lab that is part of Research Innovation Organisation at Southern Denmark University.

SDU has been implementing this strategy also in the other campuses. Three months ago, it has opened in Soenderborg, it has recently opened in Kolding and Slagelse and now it is opening in Esbjerg. They offer the same facilities, but in Odense, the headquarter, they are more implemented. In Odense, they offer a simple office desk, called flex desk so, you don't have your own office, but you take what it is free. The teams generally come at different intervals so, the space is enough for all at the end. For this reason, you cannot book your space, but you just take whatever is free.

In addition to the office space with the flex desks, it offers five or six meeting rooms with different dimensions. Then, it has two rooms called *thinking space* where the team can brainstorm and where you can do soft prototyping with paper and stuff like that. There is also a pitching space to prepare the pitch. Another facility is the mega space where there are four 3D printers to use for prototype. The students can use the facilities until six months they have finished the studies.

The incubator program is financially supported by SDU so, without any external support. For example, in Copenhagen, the Danish Technical University (DTU) is helped by bigger companies that invest money sponsoring the university incubator.

In 17 months, SDU Entrepreneurship Lab has gone from having 14 startups to today having had 112 startups, 201 people associated and involved, and twelve startups have obtained external capital to develop themselves.

Figure 4.20: Entrepreneurship Lab's statistics.



SOURCE: (Research Innovation Organisation, 2017)

It aims to build good start-ups. The number of the teams is not important because many teams does not mean high performance so, it focuses on good teams able to develop great idea and profitable start-ups. It teaches to their students a lot of things from the basic steps to the more complex, but it knows that it is not easy to be successful. In Cortex Lab, they know that many ideas will be fails and many entrepreneurs will not be successful, at least not in the first trial and maybe also in the second one, but they believe that if they don't succeed as entrepreneur then they will succeed on getting a job because they develop important skills doing these activities so, they develop an advantage respect to other candidates. There was a team that failed several times during the summer, but it was one of the best team of the program because it failed 3 times within three months and now it knows perfectly what to do, what to focus and where you can get a profit. Now they found a company, they are earning money, they have hired people and they are located at "Coworking plus", one of the biggest private coworking organisation outside Copenhagen.

It helps the start-ups in different ways, giving them general information, but also training them with practical exercises. When new teams enter in the environment, knowing that a big part of the teams are going to fail, they try to accelerate this process so that the teams do not spend two years on an unsuccessful project and they can skip to another one. A classical exercise can be the survey to potential customers. It happened that a team went to the shopping centre to interview 100 people about their idea. So, the team spent one day, but it has understood what customers think about their idea and if this is working or not.

There are generally two ways to help the teams. One way is to sit down with each of the teams, planning their activity and giving them specific deadlines. The other way is to get a couple of teams together that are at the same level, and then you organise workshops on a specific topic.

It does not provide any financial aid, it just helps to find out investors. Anyway, even if it is not official, there is a business angel who gives 100000 DKK each year given to some teams selected by an external panel.

The University does not have any financial payback. In Copenhagen, the ITU takes some share of each company that they allow to enter in their program. SDU believes that if

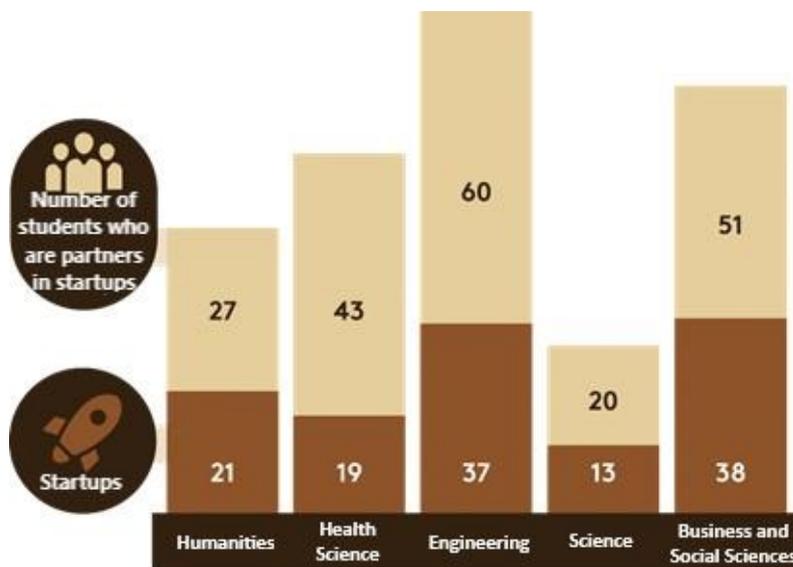
students create new businesses, the entire society can obtain something back especially jobs for the other students.

It has not external official collaboration because it is not allowed, but there are some not signed agreements with various actors such lawyers who come there and speak about some specific content to help the start-ups on that. It is more like a network based on personal relationships.

The students collaborate across faculties to have a wide range of skills in their startups. Therefore, a startup can be represented under several faculties.

As the figure below (Figure 4.21) shows, the engineering students are a big share, but also students from health science and business and social sciences. The participation depends a lot on the teachers and professors and their capacity to involve students in the study activities and also bringing them there to know the opportunities that they have in this Lab.

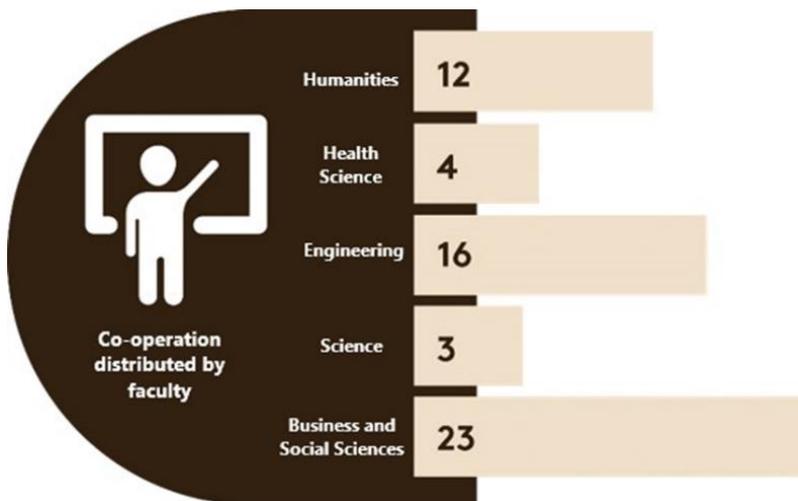
Figure 4.21: Startups and number of participants based on faculty.



SOURCE: (Research Innovation Organisation, 2017)

The Entrepreneurship Lab has developed several programs where all the university is involved with the various faculty as shown in Figure 4.22.

Figure 4.22: Co-operation distributed by faculty.



SOURCE: (Research Innovation Organisation, 2017)

The main programs are presented below.

“*Startup Station*” is the main program that aims to create new teams for the development of new startups. It is composed by four main steps, it aims to develop the idea and find investors to create the business. Of course, many times these steps are not completed because the teams realise that the idea is not profitable so, they stop the project before and maybe they will start another one.

The “*Company Meet-up*” is a program organised to match existing big companies with the teams so, usually on Wednesday, some big companies go there, introduce themselves and then they talk with teams. So, the companies, if they have identified some potential teams, can buy their product, invest in the start-up or offer internships. It is a way to find investors for the teams and identify new good ideas for the companies that maybe have been for a long time in the industry and now they need to innovate.

The “*Business Accelerator*” is a program, not yet well defined, that it will be launched soon. Three or five teams among the hundred ones will be selected and they will have the possibility to be part of this program receiving more attention and help by the incubator team.

The “*Talent Program*” is a one-year interdisciplinary talent program, which gives 20 ECTS for the students.

For the program 2016/17 and 2017/18, a total of 115 students from all faculties and from several campus towns have applied for admission, but only 50 students are

admitted and have created 13 startups during the programs. Of these, two have been selected as finalists in Venture Cup's National Idea Competition, and one has received funds from a special Fund for Entrepreneurship. In addition, more people are already in the first half of the program progressing with their first test sales.

*“Global Entrepreneurship Week”* is a Pitch event, where Startups from *“Startup Station”* and the *“Talent program”* pitch their businesses for various external stakeholders, including potential mentors, investors, established companies and entrepreneurs from external networks.

*“Agenda workshop”* are workshops organised to help the Startup Station’s companies on specific topics such as the workshop on law held by some lawyers.

SDU Entrepreneurship Lab’s events attract more than 200 external visitors who go there to meet entrepreneurs and business developers. It is from entrepreneurs of other incubation environments to established companies, potential mentors, potential investors and consultants. It is a point of reference for the business environment of the region.

Several meetings are organised with the community partners in the ecosystem. For example, meetings with business, collaborative partners, investment funds, public and private in entrepreneurship initiatives.

*Figure 4.23: External visitors in the incubation environment.*



SOURCE: (Research Innovation Organisation, 2017)

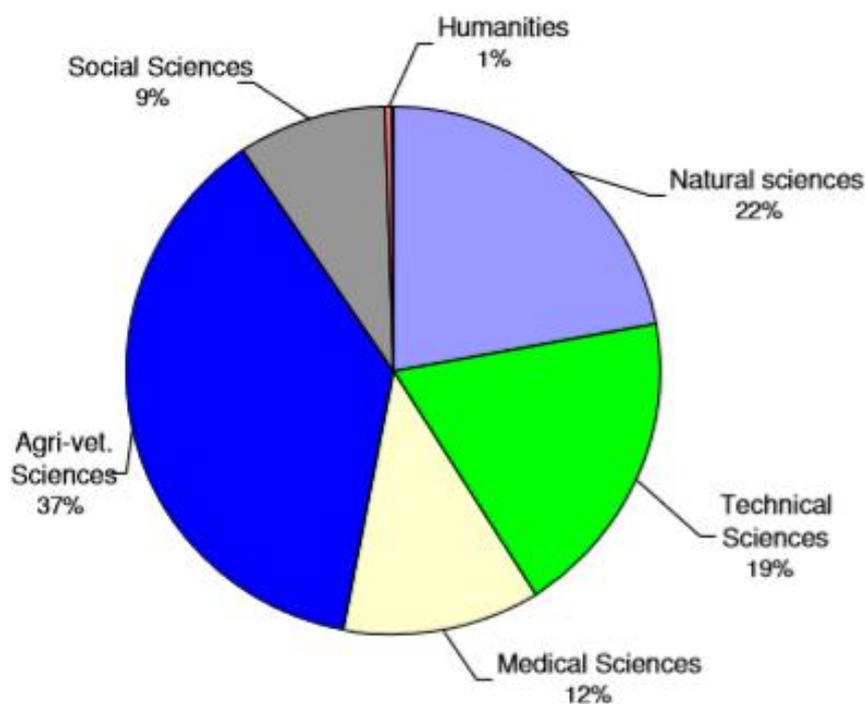
#### 4.3.2 Government research institutions

The government research institutions activities are 22. The institutions are financed by the first tier through basic grants from the Financial Act. In 2003, they received 13% of the R&D grants that corresponds to about 1.2 billion DKK. In addition to these resources, these institutions received on billion more from the National Research Councils, other funds, enterprises and international funds.

The government research institutions held the 20% of the total R&D FTE whereas the universities and other institution of the high education system held the 57%.

The Figure shows the R&D FTE according to the specific scientific areas. Agricultural and veterinary sciences and natural science held the 37% and 22% respectively. The other areas such as technical, medical and social sciences have a medium share. Instead humanities held an irrelevant share (1%). (Danish National Research Foundation, 2005)

Figure 4.24: R&D FTE at Government Research Institutions according to Scientific Area, 2003.



SOURCE: (Danish National Research Foundation, 2005)

### 4.3.3 Private enterprises and research labs

The private sector was worth the 60% of the total R&D Full time Employees. It had a value of 21.022 R&D FTE against the 14.386 of the public sector. So, the private sector is an important source for R&D expenditure. (Danish National Research Foundation, 2005)

Private research organisations concentrate their research on sciences and biotechnology. For example, as can be seen below, in 2013 (Figure 4.25), the Novo Nordisk Foundation, focusing on medical sciences and technology, granted 105 million of Euro for both basic and applied research. It is half of what is provided by Innovation Fund Denmark.

Figure 4.25: Private Funding agencies in Denmark for research, innovation and tertiary education.

Organization/Foundation	Orientation	Funding (mio. euro)	Target of Funding	Instruments and schemes
Lundbeck Foundation	Basic research, applied research	64	Public research institutions	<ul style="list-style-type: none"> <li>Personal grants: Funding of academic staff</li> <li>Talent prizes</li> <li>Strategic grants for research projects</li> </ul>
Novo Nordisk Foundation	Basic research, applied research, innovation	105	Public research institutions	<ul style="list-style-type: none"> <li>Research projects</li> <li>Scholarships</li> <li>PostDoc fellowships</li> <li>Investigator grants</li> <li>Prizes</li> </ul>
Carlsberg Foundation	Basic research, applied research, market development	30	Public research institutions, small and medium-sized enterprises	<ul style="list-style-type: none"> <li>Research projects</li> </ul>
AP Møller Foundation	Basic research, applied research, innovation	121*	Public research institutions	<ul style="list-style-type: none"> <li>Grants for buildings and research equipment</li> </ul>
Realdania	Innovation	112*	Enterprises	<ul style="list-style-type: none"> <li>Innovation programs</li> </ul>
Villum Foundation	Basic research, applied research	59	Public research institutions	<ul style="list-style-type: none"> <li>Research projects</li> <li>Research centers</li> <li>PostDoc fellowships</li> </ul>

SOURCE: (Wolfgang Polt, Maximilian Unger, Michael Ploder, Daniel Wagner-Schuster, Torben Bundgaard Vad, Samuel Palmquist, 2015)

Moreover, AP Moller Foundation, involved in basic, applied research and innovation was granted 121 million of Euro to public organisations. And other organisation, Realdania, that has as target the enterprises, provided 112 million of Euro for innovation programs. Private organisations play a fundamental role in R&D activities at universities and not only. The amount of funds is increased a lot during the last twenty years indeed in 2013, it was six times higher if compared to what granted in 2000.

They are increased in size so, they are able to provide more funds for research year by year. They are now conscious that they must be more open. For this reason, the collaboration between them and public organisations is emphasised. On way of private-public cooperation is the co-financing model. An example is the collaboration with universities that share a common interest in a specific project so, they decide to co-finance together academic programs. (Wolfgang Polt, Maximilian Unger, Michael Ploder, Daniel Wagner-Schuster, Torben Bundgaard Vad, Samuel Palmquist, 2015)



## 5 Lifelong learning and the Danish Labour Market

Lifelong learning and the Danish labour market constitute two important pillars of the Danish Innovation System. They are interconnected and each one contributes to the success of the other.

Lifelong learning strategy allows to offer a continuing education and training to the citizens implementing and upgrading their knowledge. This, of course, has a positive effect on the employability of the citizens and on innovation for the companies that have a workforce more qualified and able to bring new knowledge in the firm environment.

On the other side, the Danish labour market characterised by active labour policies such as the education programs of the lifelong strategy, and the flexicurity model, allows to have a flexible market with a high rate of mobility. The job mobility implies the knowledge mobility that has a positive and significant effect on innovation inside the firms. The Danish model with the lifelong strategy and the flexicurity, enhances knowledge flows improving job matching and innovation. (Braunerhjelm, Ding, & Thulin, 2014)

### 5.1 Lifelong learning

Denmark has started an extensive reform on education to ensure a continuous growth and prosperity in the future.

The next reforms will try to ensure better quality and cohesion in the society, in education and training from the early stages to adult education.

Denmark aims to build a *world class education* system and give to everyone the opportunity to participate in its *lifelong learning* program. This is considered a precondition to develop Denmark as knowledge country inside the European Union and also in the global perspective.

The national program, recently developed, aims to ensure an excellent development and learning opportunities to strengthen the personal skills, the employability and the active participation in the Danish and European society of each citizen.

This program has to be promoted in all different contexts such as in education, at work and in adult education. The people need to acquire new knowledge to build skills and competences and ensure a better future to Denmark.

The report *“Education and Training 2010 – The success of the Lisbon strategy hinges on urgent reforms”*, published by the European Council in 2004, has moved the attention to the need of new educational reforms among the European countries. The report emphasised the need of investments in lifelong learning, retained crucial to achieve the common European goal: build the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion”. In this context, as the other EU countries, Denmark has developed in 2007 its national strategy for lifelong learning.

It is based on the Globalisation strategy issued by the Danish Government in 2006.

The main goal was to improve investments in the education systems and strengthened efforts in adult education and continuing training in order to achieve a general improvement of education and competences for the citizens.

The increasingly globalisation creates an open world with new opportunities for growth and jobs. In this context, the competitiveness and cohesion are considered two preconditions for the generation of the Danish welfare state.

Considering Danish context, the Scandinavian country has a strong position for what concerns employment and unemployment, equitable income distribution, education expenditure and education level of the population. Moreover, the labour market is characterised by flexibility and for this reason it is considered as one of the most competitive country, also for what concerns investments in human resources development. (Hedegaard & Danish Ministry of Education, 2007)

In 2014, Denmark had a general government expenditure on education as a percentage of the GDP, equal to the 7.2% instead the European average was 4.9%. In addition, the employment rate of medium-qualified workers was about 80.3% in 2015 while the EU average was 73.9%. The same situation if the employment of low-qualified workers is compared: in Denmark was 60.5% and in the EU average was 53.2%. The employment of highly qualified workers is almost the same of the EU average, indeed, it is 85.9 for Denmark and 84.1 for EU. (European Commission, 2016)

The qualified work force will become crucial to achieve the competitiveness and growth. The demand on general and vocational skills will grow and the demand of low skilled labour will decline in the future. So, the skills must be improved at all levels to face the next global challenges. For this reason, it is important to increase the adult education and a continuing training.

In order to face these challenges, it becomes crucial to build a world class education.

The Danish Government aims to be one of the most attractive countries to live and to work in, a place where everyone has the opportunity to build personal skills and competencies in order to create welfare conditions for the society.

The globalisation strategy focuses on training and lifelong program. A high level of educational attainment and opportunities for lifelong learning are two preconditions to achieve the national objectives.

In general, the enhancement of skills and strengthening of adult education and training is a shared responsibility for employers, employees and public authorities.

The Government's strategy for education and lifelong abilities, covers all forms of education and learning in order to achieve the final goal.

The Government has the following nine objectives as specified in the national strategy implemented in 2007:

- 1. "A coherent education system from preschool to higher education must provide the opportunity for everyone to acquire excellent basic skills, a qualifying education and a solid foundation for lifelong learning. There must be equal opportunities and room for all.*
- 2. Education must be world-class. The education system shall foster talent and be more accommodating to weak learners. Quality is given pride of place, and education must match the needs of the labour market and the society.*
- 3. There must be relevant, high quality adult education and continuing training for everyone in the labour market which matches the needs and puts particular emphasis on the need for lifelong skills upgrading for those with the lowest level of education. There is a shared responsibility to ensure that everyone in the labour market is engaged in lifelong learning.*

4. *Systematic competence development in the workplace should be strengthened in both public and private enterprises. Increased public and private investment in continuing training and competence development for employees shall contribute to improving the skills of individuals and strengthen the development of the enterprises.*
5. *Opportunities for guidance and counselling must be improved and help ensure the best possible conditions for pupils, students and adults to choose education programmes and to participate in lifelong learning.*
6. *All forms of education and learning should be based on and build on the knowledge, skills and competences of individuals. In adult education and continuing training new and improved opportunities shall be created promoting visibility and recognition of an individual's prior learning.*
7. *Coherent education paths and transparency in the education system are to contribute to targeted education and lifelong skills upgrading and facilitate the best possible use of public resources.*
8. *A global perspective must be included in all education programmes contributing to strengthening internationalisation and cooperation with the world around us.*
9. *Stronger higher education environments are to be created in order to contribute to higher quality in education and knowledge development, and a better framework and better conditions shall be developed for interaction between educational institutions and enterprises and other relevant players."*

(Hedegaard & Danish Ministry of Education, 2007)

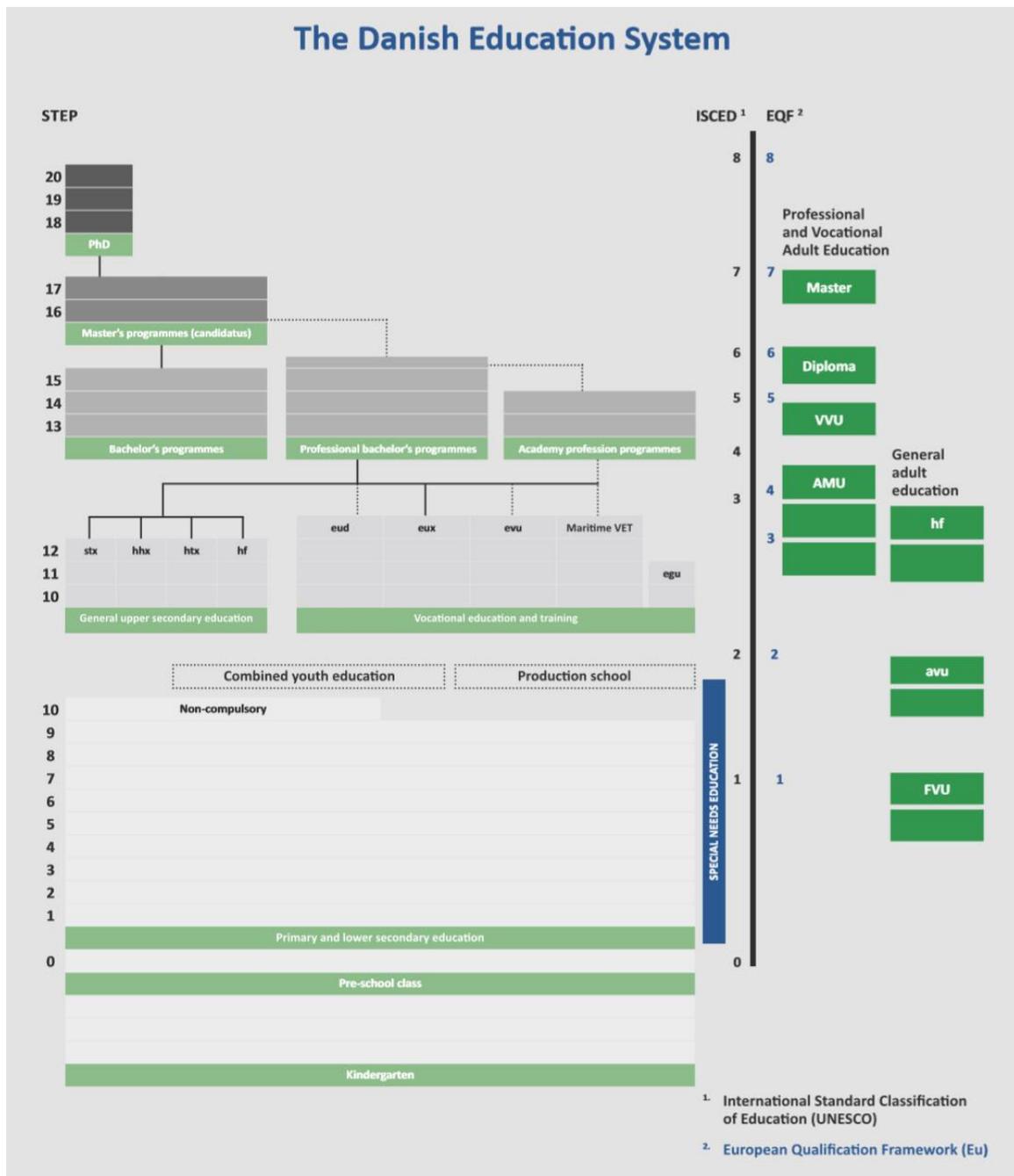
The Figure 5.1 shows the Danish Education System, from the pre-school to adult education, that is necessary to ensure the achievement of the objectives set by the government.

The Danish Education System is composed by four main levels:

- Preschool
- Compulsory basic school
- General and vocational upper secondary education
- Higher education

On the right side, is shown the adult education system. The focus will be on adult education that it is becoming more important than during the past for several reasons.

Figure 5.1: The Danish Education System.



SOURCE: (THE DANISH GOVERNMENT, 2016)

The continuous changes in the labour market create new demands on the skills and adaptability of individuals. The participation in adult education and lifelong training helps the citizens to be active in the job market. In the other hand the competitiveness and the service quality of Danish enterprises depends on continuous education and training. So, an increased effort in this direction is needed to develop Denmark's economy and society.

Nowadays, Denmark has a high level of participation in adult education and continuing training indeed, as shown in the "Education and Training monitor 2016" edited by the European Commission, it has an adult participation in the lifelong learning of 31.3% against an EU average of 10.7% (in 2015). (European Commision, 2016; Hedegaard & Danish Ministry of Education, 2007)

Social partners usually enter into job agreement influencing the capability development and improvement in the firms.

The main role is played by the public sector that provides opportunities for any kind of worker of the labour market from the low skilled to the high qualified one.

It is important that a greater part of adults get involved in adult education and that training activities are implemented also in the enterprises. The enterprises do not invest enough money on training in particular for what concerns small and medium-sized companies.

It is crucial to encourage public and private firms through incentives to become learning workplaces to contribute to develop their human resources and answer to the new market needs.

The government, with a contribution of social partners, established the following key initiatives:

1. *"Guidance and counselling for employees and enterprises is to be strengthened.*
2. *Better and easier access to recognition of prior learning is to be ensured in all publicly financed adult education and continuing training programmes from basic adult education to diploma (bachelor) level.*
3. *A significant effort to increase participation in literacy and numeracy courses for adults. Provision is to be made more flexible, and the possibilities of*

*combining literacy and numeracy courses with adult vocational training are to be utilised better.*

4. *Better provision for bilinguals who have problems with the Danish language will be developed in Danish language education programmes for foreign adults and in other general and vocational adult education to ensure that they can cope in the labour market and as citizens.*
5. *Adult education and continuing training provision in, for example, labour market training will be made more attractive, targeted and flexible in relation to the needs of individuals and enterprises.*
6. *A better and broader range of qualifying adult education programmes at higher education levels shall be developed in the adult further education system.*
7. *The number of adult apprentices who can obtain a vocational education and training qualification shall be increased through increased State grants.*
8. *Ensuring institutions' conditions of provision, more flexible tuition fees and a new model for financing special allowances in vocational adult education and continuing training are to be discussed with the social partners and the political parties behind the welfare agreement.*
9. *Systematic competence development in small and medium-sized enterprises will be promoted in public as well as private enterprises through, among other things, the development of methods and tools.*
10. *Increased public and private investment in adult education and continuing training will be promoted.*
11. *The progress of efforts in the area of adult education and continuing training will be monitored through the development of an indicator system."*

*(Hedegaard & Danish Ministry of Education, 2007)*

In Denmark, the Adult Education System can be divided in two subgroups: formal and non-formal. The non-formal is represented by the self-governing institutions that offer lifelong learning without formal examinations.

Today, the Danish System is in transition due to the new global challenges.

The educational organisations such as the universities, are self-governing institutions and they aim to ensure broad educational environments offering many learning options for any kind of student all around Denmark.

Because of their independency, these institutions operate autonomously ensuring a high level of educational quality, but they are guided by the Ministry of Education who is responsible for the continuous supervision and development of guidance services.

In 2000, the Danish government, with a reform of the vocational education and continuing training system, improved the continuing training and brought additional education programmes to create a coherent and transparent adult education system.

The reform introduced several improvements:

- A new system of adult education and continuing training;
- A new form of educational support for adult;
- A new grant allocation schemes for institutions offering these kinds of programmes.

Moreover, the programmes are organised to be comparable to the ordinary education system.

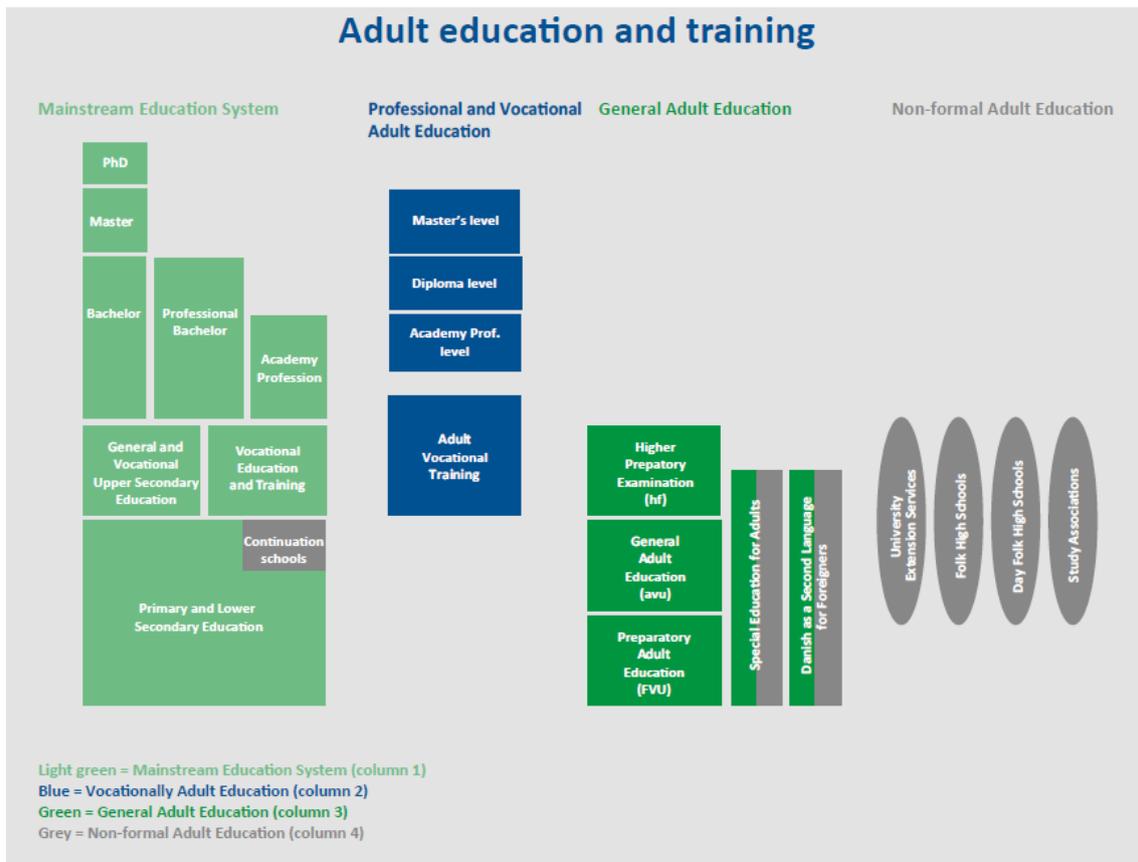
The government, with this reform, had three goals:

- Provide relevant adult education and continuing training offers to all adults, from low skilled to high qualified workers;
- Improve opportunities for those with the lowest levels of education;
- Optimise the use of the invested resources.

The system is continuously under development and improvement indeed, in 2007, new reforms were introduced to ensure youth education giving the responsibility of the upper secondary schools and higher preparatory examinations to the state with the aim to link better the education for adults. In addition, the adult education centres (VUC), the preparatory adult education (FVU) and the general adult education (AVU) were transferred to the state. (European Association for the Education of Adults, 2011)

The Figure 5.2 shows a description of the Adult Education system including the formal and non-formal programmes.

Figure 5.2: Adult Education System.



SOURCE: (THE DANISH GOVERNMENT, 2016)

The formal system includes various training programs:

1. Preparatory adult education (FVU)
2. General adult education (avu)
3. Higher preparatory single subject courses (hf-e)
4. Adult vocational training (AMU)
5. Vocational education and training for adults (euv)
6. Further adult education programmes (VVU)
7. Diploma programmes
8. Master's programmes

The first one aims to improve basic skills in reading, writing and mathematics of adults who do not have sufficient qualifications to follow training or to face the new demand skills of the labour market.

The General adult education offers education to improve knowledge and skills at lower secondary level. All adults have the right to access AVU and the qualification level is the same as the standard secondary education.

The third one offers general education as the previous one, but at the upper secondary level.

The Adult vocational training is designed for unskilled and skilled workers in the labour market, but everybody may participate independently of the educational background. The programmes are continuously developed and updated according to the labour market demand. This program contributes to maintain and improve the vocational skills and competences of participants considering the needs of the market. Moreover, it contributes to solve labour market restructuring and adaptation problems in short-term and long-term perspective.

The vocational education and training for adults provide the opportunity to acquire a VET (Vocational education and training) qualification to become a skilled worker within the VET system. It is dedicated to adults of 25 years and over.

The VVU program is the level of the ordinary academy profession programmes.

The last two programs correspond to the bachelor and master level of the higher education system. (Ministry of Higher Education and Science, Ministry for Children Education and Gender Equality, & Ministry of Culture, 2016)

There are four main providers for the Danish formal Adult Education:

1. Language centres
2. Adult Education Centres (VUC)
3. Labour Market Training Centers (AMU)
4. Centres of Higher Education (CVU) such as technical, schools, business schools, agricultural schools and basic social and health service schools, and universities.

The second one is the main provider of General Adult Education and since 2007 they are independent institutions and not governed by the region. They are financed by the Danish government via the taximeter funding.

In Denmark there are 29 VUCs, but there are a number of associated satellite departments spread geographically in all the country.

These centres offer other education program such as preparatory education for adults, higher preparatory examination courses and education for people with reading and writing disabilities, for example the dyslexia. (European Association for the Education of Adults, 2011; Ministry of education, 2018)

On the other side, there are several schools that operate within the framework of non-formal adult education.

The “Folk high schools” are the most well-known and they offer residential courses through mutual learning taking into account the prior experience. There are not formal examinations. The subjects usually change several times covering various topics such as politics, arts, music and personal development subjects. The courses usually take four or five months.

The “Day Fold High Schools” offer programs which usually have a learning for enjoyment aim. The teaching is usually full time and during a period of 4-18 weeks. This kind of schools sometimes offer Preparatory Adult Education.

The evening schools and study associations offer teaching, study circles, lectures and other activities. The aim of this voluntary learning is to strengthen adult learning in particular create an active citizenship.

The “University Extramural Departments” are a nationwide system with a regional structure consisting of four divisions in the major universities of Copenhagen, Aarhus, Odense and Aalborg. They try to disseminate knowledge of the methods and research outcomes through a non-formal adult education lectures. (European Association for the Education of Adults, 2011)

As confirmed by the long description of the Education System, Denmark has a complex and well developed strong lifelong learning system. The government has recognised its importance and it is constantly working on its development and improvement because of it is becoming crucial for the country prosperity from the economic point of view, but also from a social perspective.

## 5.2 The Danish Labour Market and Employment Policy

During the last ten years, Denmark has been characterised by a high rate of employment that, as shown in the Table 5.1, in 2016, was equal to 77.4%.

The unemployment is increased during the crisis reaching the highest value in 2011, but it has started to decrease, reaching the 5.7% in 2016. Not only the unemployment rate has started to decrease, but also the long-term unemployment rate; this means that there are less people who remain out of the labour market for a long period.

The table shows an interesting comparison between Denmark and Italy. In Italy, the long-term unemployment rate is quite high, and it is mainly due to the unsuccessful policies to reintegrate unemployed people. (European Commission, 2018a)

*Table 5.1: Labour market participation 2005 – 2017 (% of the total workforce)*

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
<b>Employment rate %</b>	Denmark	78.0	79.4	79.0	79.7	77.5	75.8	75.7	75.4	75.6	75.9	76.5	77.4	76.9
	Italy	61.5	62.4	62.7	62.9	61.6	61.0	61.0	60.9	59.7	59.9	60.5	61.6	62.3
<b>Unemployment rate %</b>	Denmark	4.8	3.9	3.8	3.4	6.0	7.5	7.6	7.5	7.0	6.6	6.2	6.2	5.7
	Italy	7.7	6.8	6.1	6.7	7.7	8.4	8.4	10.7	12.1	12.7	11.9	11.7	11.2
<b>Long-term unemployment rate %</b>	Denmark	1.1	0.8	0.6	0.5	0.6	1.5	1.8	2.1	1.8	1.7	1.7	1.4	1.3
	Italy	3.7	3.3	2.9	3.0	3.4	4.0	4.3	5.6	6.9	7.7	6.9	6.7	6.5

SOURCE: AUTHOR'S ELABORATION FROM EUROPEAN COMMISSION (European Commission, 2018a)

Moreover, the Danish labour market is characterised by the highest rate of mobility if compared to other European countries (Figure 5.3). The 30 % percent of workers change job every year. (Confederation of Danish Employers (DA), 2008)

Figure 5.3: Job mobility in 2005.



SOURCE: (CONFEDERATION OF DANISH EMPLOYERS (DA), 2008)

The situation is completely the opposite in Italy where the wage earners have on average had less jobs in the course of their working careers respect to other European countries such as Denmark.

The success of Danish labour market is the result of various factors such as high dynamism of the entire market, the high flexibility, the high social protection, the active labour measures and also the well-structured lifelong learning strategy introduced in the previous paragraph. These different, but interconnected factors, has led to what is defined as the flexicurity model.

### 5.2.1 Active Labour Market policies (ALMP)

Labour market policies are fundamental for the success of the economic policies and in Denmark they focus on employment and the development of the workforce. The implementation of labour policies is the result of the coordination at the central and regional levels.

In 1990, Denmark introduced important policies, shifting towards active labour market measures. More attention was on workers and their skills, on the improvement of their

capabilities and competencies especially for those who were unemployed in order to give them new job opportunities.

Activation was not just considered a right, but it was also a duty for workers and for this reason, in 1997, the European Commission defined this new development as workfare, an evolution of the welfare state.

Activation means the participation to general and vocational guidance, job search assistance, individual job-oriented plan, job training, education, job rotation. Various reforms were been introduced in the last years and they are continuously implemented to improve their social and economic effects.

The aim of this active labour policies is to create the flexible labour market with unemployment benefits and the right and obligation to participate actively to programs. These policies are linked to the lifelong learning strategy, the final aim is the same, but both are needed in order to enable Denmark to meet the new challenges of the globalisation, the demographic change and the need of constant upgraded qualifications.

The reforms undertaken by Denmark had great results because they increased employment, decreased the average period of unemployment and youth unemployment, and improved the labour force's adaptability to the labour market. (Jan Hendeliowitz, 2008)

In Denmark, the active labour policies constitute an important part of the reforms and a high share of public expenditure (Table 5.2). In 2016, the country has spent the 2.07% of the GDP on active measures and just the 1.15% on passive measures. (OECD, 2018)

*Table 5.2: Public expenditure and participant stocks on LMP (% of the GDP).*

<b>Year</b>	<b>2004</b>	<b>2006</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2012</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
<b>Total</b>	4.23	3.26	2.51	3.27	3.75	3.58	3.44	3.33	3.22
<b>Active measures</b>	1.64	1.46	1.34	1.61	2.02	1.94	2.04	2.05	2.07
<b>Passive measures</b>	2.59	1.80	1.17	1.66	1.73	1.64	1.40	1.28	1.15

SOURCE: AUTHOR'S ELABORATION FROM OECD, 2018.

In 2015, the government introduced a new reform of the Active Labour Market Policies with a specific focus on education because it is significant and crucial for unemployed people and for the enterprises that need a qualified workforce.

The reform introduced five main changes:

1. Now the unemployed, both skilled and low skilled, have the right to six weeks of training programs from the first day of unemployment. The training is offered through the AMU (Adult vocational training) programs introduced on Lifelong Learning section.
2. The job Centres have extra funds to buy short training programs for all unemployed people who receive benefits. The social partners, now more involved in this context, decide what training programmes the Job Centres can get financed from the extra funding, taking in consideration the market demand.
3. Now unskilled unemployed over 30 years of age who receive unemployment benefits, will get the possibility to apply for one of the vocational training program VET (Vocational education and training) to be finished within the duration of benefits of two years.
4. The unemployment benefit will be reduced to 80% of the normal level. It is offered a loan to draw the full benefits during the training, before repaying it when the program ends.

Unemployed people over 30 years have the right to an assessment of their competences, both formal and informal. In this way, it is given credit to competences acquired with education.

5. Unemployed people under 25 years of age without formal education have to take a test to assess the basic skills and if they don't pass the exam, they have the duty to participate in training to improve their competences. (The Danish Agency for Labour Market and Recruitment, 2015)

Three examples of active labour measures are the Job rotation scheme, the Adult apprenticeship scheme, Upgrading of skills through employment.

1. The job rotation scheme allows an enterprise to be eligible for job rotation benefits it gives the possibility to an employee to participate to a training

program and it hires temporarily an unemployed person as substitute. The temporary worker must be unemployed for a minimum of six months and it is allowed to be employed as substitute for up to six months.

2. The second measure gives the possibility to a firm *“to receive a subsidy for a salary paid in the practical period when they enter into a training agreement with adults who are at least 25 years at the beginning of the program”* (The Danish Agency for Labour Market and Recruitment, 2018a).
3. With the third one, when employing a person in an ordinary job, *“the job centre can grant subsidies to an employer to cover their expenses incurred in connection with upgrading the skills of the employee. The job centre can grant subsidies for training employees who has been unemployed for 12 months. People under 30 years old or people who are at risk of becoming long-term unemployed can get into the scheme after six months of unemployment* (The Danish Agency for Labour Market and Recruitment, 2018a)“.

#### 5.2.2 The unemployment benefit system

The main reason why trade unions are willing to accept flexible conditions for employers, is the unemployment insurance (UI) benefits that constitute one of the main important policies.

The unemployment benefit aims to enhance the flexibility and the mobility of the entire labour market for the companies and for workers.

In 2016, the government introduced a new reform with three main objectives:

- *to increase flexibility, which in concrete terms means generating confidence in such a way as more closely than today supports the unemployed in accepting the broad range of jobs offered on ordinary terms on the Danish labour market.*
- *to create greater security for insured unemployed.*
- *to modernize and update the unemployment benefit system so, it will be simpler, more transparent and easier to manage, and adapted to a more flexible and international labour market.*

There are 36 state-approved funds for Unemployment Insurance funds that administer the insurances of 2.1 members that corresponds to the 77% of the total workforce. (Jan Hendeliowitz, 2008)

The major part of unemployed people, if they have an unemployment insurance, receives an economic benefit calculated at the rate of 90 percent of the employed income. Anyway, there is a maximum rate of 849 DKK per day.

The members must have received an income of at least 223.428 DKK within the past 36 months. Moreover, a monthly income of 18.619 DKK applies, so the prospective beneficiaries need to have worked for at least 12 months. Now, income is a more important than hours worked even if they remain a qualifying criteria for access to the benefits.

Then, the worker must be a member of an unemployment insurance fund for at least one year.

The benefit period is 2 years within a 3 years period with the possibility to obtain one year more, working for a period of half a year during the benefit period. (The Danish Agency for Labour Market and Recruitment, 2018b)

Moreover, it is possible to receive temporary unemployment benefits:

- *involuntary reduction of working hours;*
- *part-time work accepted to avoid full unemployment;*
- *interruption of work for meteorological reasons.*
- *the monthly payment is reduced in proportion to the hours worked. The recipient is entitled to receive partial unemployment benefits for 30 weeks out of a period of 104 weeks.*

(The Danish Agency for Labour Market and Recruitment, 2018b)

### 5.2.3 The Job Centres

In Denmark there are more or less 91 job centres, both Public Employment Service (PES) and the employment authorities in the municipalities. They collaborate sharing the common aim of employment promotion.

The state is responsible for unemployed workers with the insurance and the municipalities are responsible for unemployed people without insurance. Even if the responsibilities are divided, they must collaborate to offer a joint employment effort for citizens and companies.

The Job Centres have the role to combine the local and central service and provide an efficient employment system offering access to the society. Before the division between insured and uninsured was stronger, there were two different responsible offices.

They are fundamental for the labour market in Denmark, they have to match jobseekers and company in the most efficient and quick way. (Jan Hendeliowitz, 2008)

The job centres offer various kind of services to help jobseekers to upgrade their competencies, expand their network, get relevant work experience and improve their CV and job application. (Københavns Kommune, 2018)

In general, they offer three types of active employment measures:

- Education and training activities to upgrade their skills.
- Subsidised jobs at public or private organisations to retrain unemployed people.
- Practical work training at public or private employers to upgrade qualification for jobseekers.

#### 5.2.4 The role of social partners

As introduced before, in Denmark, the social partners have an important role, there is a tripartite co-operation between trade unions, employers' organisations and the State. This peculiar situation has allowed to build the flexible labour market and strong mediation based on agreements rather than regulation that is quite low in Denmark. As long as the players are able to coordinate themselves, manage pay and working conditions, the Danish state will not interfere.

This means that the tripartite co-operation and interaction is an integral part of the labour market policy also for what concerns safety, health, job placement and unemployment insurance that usually are primarily regulated by legislation.

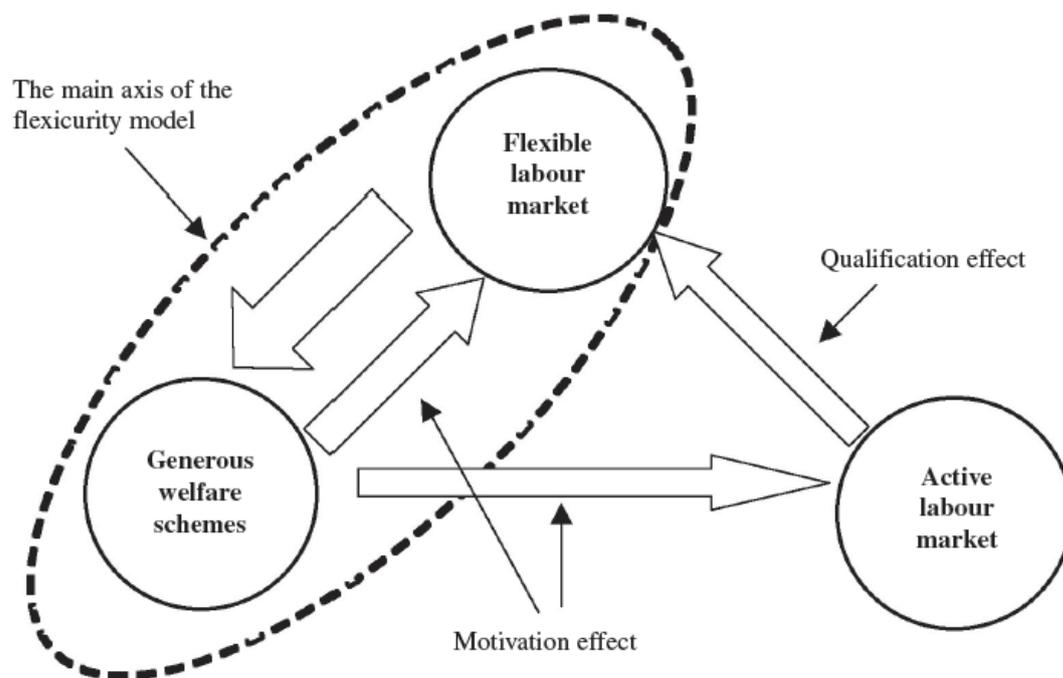
Danish employees trust trade unions indeed, more than 80% belong to a trade union. In Denmark, there are national confederations who group various trade unions. The main confederations are the Confederation of Trade Unions (LO) and the Confederations of

Danish Employers (DA) that have respectively 1.3 million workers and 29.000 private companies. (Jan Hendeliowitz, 2008)

### 5.2.5 The flexicurity Model

The other central pillar of the Danish system is the flexicurity model that supports a combination of flexible labour market, generous welfare scheme and active labour market policy. These are the three main components of the system, also known as the Golden Triangle (Figure 5.4). (Bredgaard, Larsen, & Madsen, 2006)

Figure 5.4: The Danish flexicurity model.



SOURCE: (Bredgaard et al., 2006)

The term has origin from the combination of two words: flexibility and security. On one side flexibility for the employers and on the other side security for the employees.

In 2004, Wilthagen and Tros have defined flexicurity as *“a policy strategy consciously striving to enhance the flexibility of the labour markets, work organisation and labour relations on the one hand, hand to enhance security -employment security and social*

security - notably for weak groups in and outside the labour market on the other hand” (Wilthagen & Tros, 2004).

This is the result of the perfect combination of three elements introduced before that allow to ensure the balance existing today between the two sides: flexibility and security.

The recent study “*Doing Business: Understanding Regulation*” published by the World Bank in 2004, presents a flexibility index of the national regulation composed by three sub-indexes: “Flexibility of hiring”, “Condition of employment” and “Flexibility of firing” (Table 5.3). As it can be easily seen, Denmark is ranked as the most flexible country for employment laws. In particular, it shines for the employment conditions, but also for what concerns hiring and firing flexibility, it is ranked second and third respectively. (Andersen & Mailand, 2005)

Table 5.3: Indexes on the employment regulation - the ten most flexible EU - countries, incl. Norway (Index)

Flexibility of hiring		Conditions of employment		Flexibility of firing		Employment laws	
Czech Republic	17	<b>Denmark</b>	25	United Kingdom	9	<b>Denmark</b>	25
<b>Denmark</b>	33	Norway	39	Austria	14	United Kingdom	28
United Kingdom	33	Sweden	39	<b>Denmark</b>	17	Austria	30
Austria	33	Austria	41	Belgium	22	Czech Republic	36
Belgium	33	United Kingdom	42	Hungary	23	Norway	41
Poland	33	Finland	43	Norway	25	Sweden	42
Slovakia	34	Germany	46	France	26	Belgium	48
Hungary	46	France	61	Czech Republic	27	Ireland	49
Ireland	48	Italy	62	Ireland	30	France	50
Netherlands	51	Czech Republic	63	Lithuania	31	Germany	51

Note: Indexes range from 0 to 100, with higher values indicating more-rigid regulation. The Employment-laws index is the average of the flexibility-of-hiring, conditions of employment, and flexibility-of-firing indexes.  
Source: The World Bank (2003:36)

SOURCE: (ANDERSEN & MAILAND, 2005)

The regulation in Denmark is not so strong and it is through collective agreements indeed, the ranking presented above is not the result of the flexible Danish regulation, but the role played by the social partners on the collective agreements.

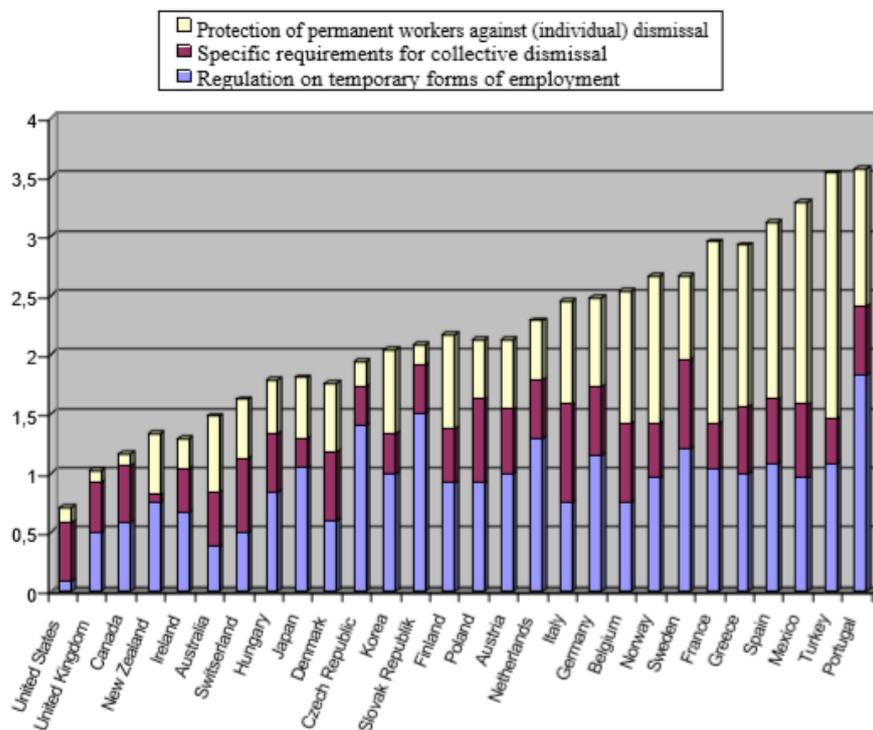
Another study published by the OECD, presents the EPL index, Employment Protection Legislation index, for the European countries (Figure 5.5).

The indicator is based on three different sub-indexes:

1. The protection of permanent workers against dismissal
2. Specific requirements for collective dismissal
3. Regulation on the temporary forms of employment

Here, Denmark is one the top countries among the European Union, but also considering the World context. Its EPL level is on the same level as Hungary and Czech Republic. Sweden, Norway and Finland have more protection compared to Denmark. (Andersen & Mailand, 2005)

Figure 5.5: The overall strictness of EPL in 2003.



Source: OECD 2004a:72

Note: Countries are ranked from left to right in ascending order of the overall summary index.

SOURCE: (ANDERSEN & MAILAND, 2005)

It will be analysed the factors that are the basis of the Danish model. Eight elements of flexicurity are identified: four for flexibility and four for security.

“Forms of flexibility:

1. External numerical flexibility (the flexibility of hiring and firing);
2. Internal numerical flexibility (working hours, overtime, part-time work, etc.);

3. *Functional flexibility (multi-employability, flexible organisation of work);*
4. *Wage flexibility (performance or result-based pay);*

*Forms of security:*

5. *Job security, the certainty of retaining a specific job with a specific employer;*
6. *Employment security/employability security, the certainty of remaining in work (not necessarily with the same employer);*
7. *Income security, income protection in the event that paid work ceases;*
8. *Combination security, the certainty of being able to combine paid work with other social responsibilities and obligations. This last form of security cannot be traced back to the other forms of security.;*"

(Andersen & Mailand, 2005)

1. The first element is already introduced before with Table 5.3, but the next table (Table 5.4) shows the procedural inconveniences about notice, dismissal and demands about notice and severance package.

The table is interesting because it illustrates the data also for other European countries. As it is possible to notice, UK has an overall strictness of protection against dismissal lower than Denmark, but it is not so far from Denmark.

The main difference between Denmark and UK is about the third indicator about the notice and severance pay where Denmark has a value of 1,9, almost the double of UK. (Andersen & Mailand, 2005; Confederation of Danish Employers (DA), 2008)

*Table 5.4: Indicators of the strictness of employment protection for regular employment 2003. Index 0-6.*

	<i>Denmark</i>	<i>Sweden</i>	<i>Germany</i>	<i>United Kingdom</i>
1. Regular procedural inconveniences	1,0	3,0	3,5	1,0
2. Difficulty of dismissal	1,5	4,0	3,3	1,3
3. Notice and severance pay for no-fault individual dismissals	1,9	1,6	1,3	1,1
Overall strictness of protection against dismissals	1,5	2,9	2,7	1,1

Source: OECD 2004a:112

SOURCE: (ANDERSEN & MAILAND, 2005)

Instead, Sweden and Germany have a value that is almost the double respect to Denmark. (Andersen & Mailand, 2005; Confederation of Danish Employers (DA), 2008)

2. The internal numerical flexicurity such as working hours, overtime, part-time work, is influenced and regulated by the collective agreements. Denmark, such as UK, has very limited regulation dedicated to the working time so, there is a low possibility that it affects the flexibility within this context.

The regulation implemented by collective bargaining is able to offer more local flexibility than normal legislation.

In Denmark, the most part of legislation is the result of European Union directives on the implementation of the minimum standards. They have created a common environment inside the Union, but the majority issues of the labour market are still regulated by collective agreements. (Andersen & Mailand, 2005; Confederation of Danish Employers (DA), 2008)

3. Functional flexibility concerns the capacity to carry out various activities in the same company allowing a flexible organisation for the employers.

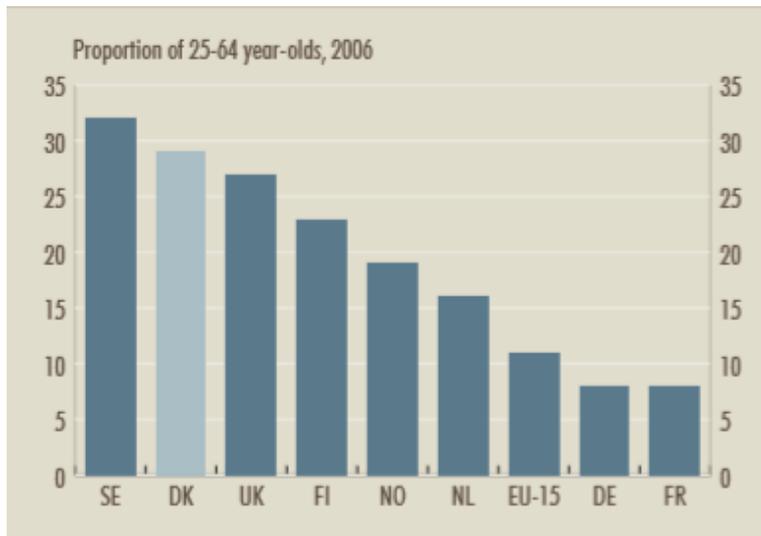
This means that an employer can use the total worker potential covering staff shortages and avoiding repetitive work. It does not work in any context, it depends on the kind of job, but where is applicable, it can be useful.

Moreover, it is correlated with education and continuing training that allows to expand workers capabilities and competencies.

In Denmark, the participation to training and education is very high respect to the European average (Figure 5.6) and this has positive effects on functional flexibility, but also on employability of the persons who are unemployed.

So, functional flexibility is not just considered as the capacity to perform other activities, but it also increases the personal knowledge and obtain qualifications not only for that specific workplace, but also for other jobs. (Andersen & Mailand, 2005; Confederation of Danish Employers (DA), 2008)

Figure 5.6: Participation in adult education and continuing education and training.



SOURCE: (CONFEDERATION OF DANISH EMPLOYERS (DA), 2008)

4. Wages flexibility is a core element of collective agreements and it is increasingly a phenomenon at local level as shown in Figure 5.7. The chance to find solution is greater at local level and the wages are more and more often set by the individual company.

Figure 5.7: Flexibility in setting wages.



SOURCE: (CONFEDERATION OF DANISH EMPLOYERS (DA), 2008)

The two major unions, the Confederation of Danish Trade Unions and the Danish Employers Confederation, operate with four types of wage system:

- Standard pay
- Minimum wage
- Minimum pay
- No fixed pay rate

The development of wages of the first type is set by the central bargaining and not local. In 2004, only the 30% of the employees was covered by this agreement. For the second and the third one, the pay is negotiated at local level and only the minimum pay rate is decided at the central level.

The last one cover the most part of employees, it is negotiated locally, and it is related to productivity gains. (Andersen & Mailand, 2005; Confederation of Danish Employers (DA), 2008)

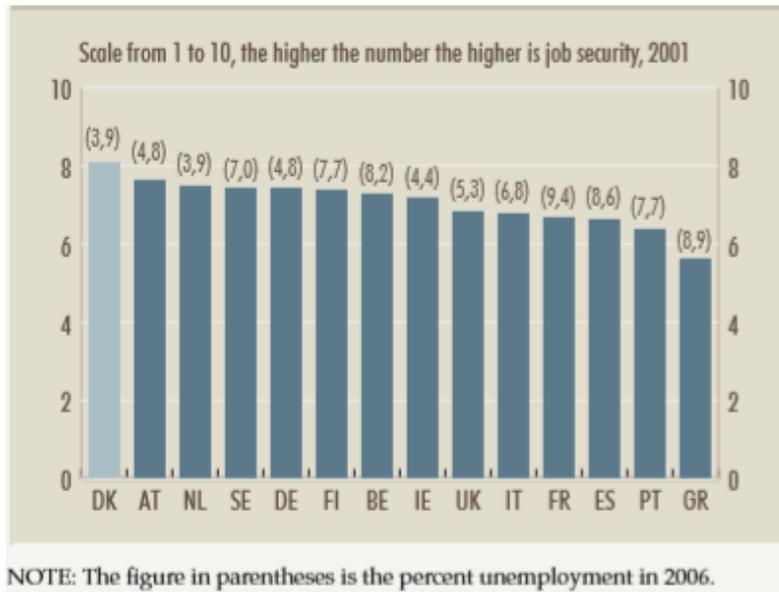
5. The fifth element relates to the security to keep the job for an employee.

In Denmark, compared to other countries, it is easier to fire an employee, but, despite the low level of employment protection, the workers perceive a high level of job security probably due also to the well-established tradition for dialogue in the companies.

So, flexibility in employment does not create a sense of insecurity among workers. Danish people think that the system is working well, and this contributes to create a general feeling of safety. (Figure 5.8)

It is easier to find the right job that best fits the personal qualifications. This represents an advantage for workers, but also for companies. (Andersen & Mailand, 2005; Confederation of Danish Employers (DA), 2008)

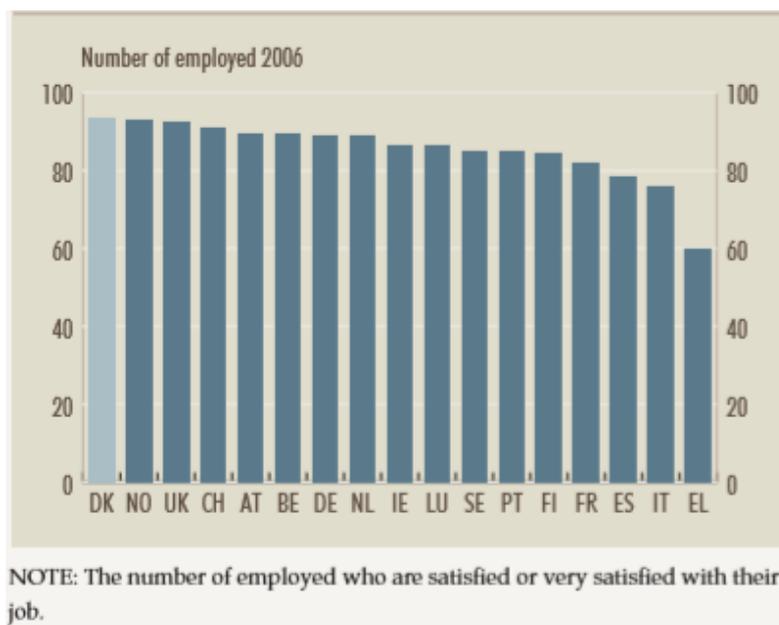
Figure 5.8: Job security.



SOURCE: (CONFEDERATION OF DANISH EMPLOYERS (DA), 2008)

Anyway, this is confirmed by the data shown on the Figure 5.9 that illustrates the job satisfaction in Denmark. Denmark is ranked in the first position and Italy is almost on the other side of the ranking. (Confederation of Danish Employers (DA), 2008)

Figure 5.9: Job satisfaction.



SOURCE: (CONFEDERATION OF DANISH EMPLOYERS (DA), 2008)

6. As in other countries, many jobs disappear every year caused by innovation and new technology, but a similar number of new jobs are created, and this give the possibility to keep the employment high. In a system with a low degree of employment security, it is fundamental to have a high degree of employment security so, the capacity to find a job easily.

The role of collective agreements is very important because they have contributed to obtain a secure rate of productivity and cost levels fundamental for the maintenance of the competitiveness of enterprises and job demand.

It happened that the trade unions have accepted a decrease of the wages in order to secure employment.

Moreover, it must be underlined the importance of continuing training and education system that give the possibility to replace people who have lost the job or to match a new job demand with unemployed people.

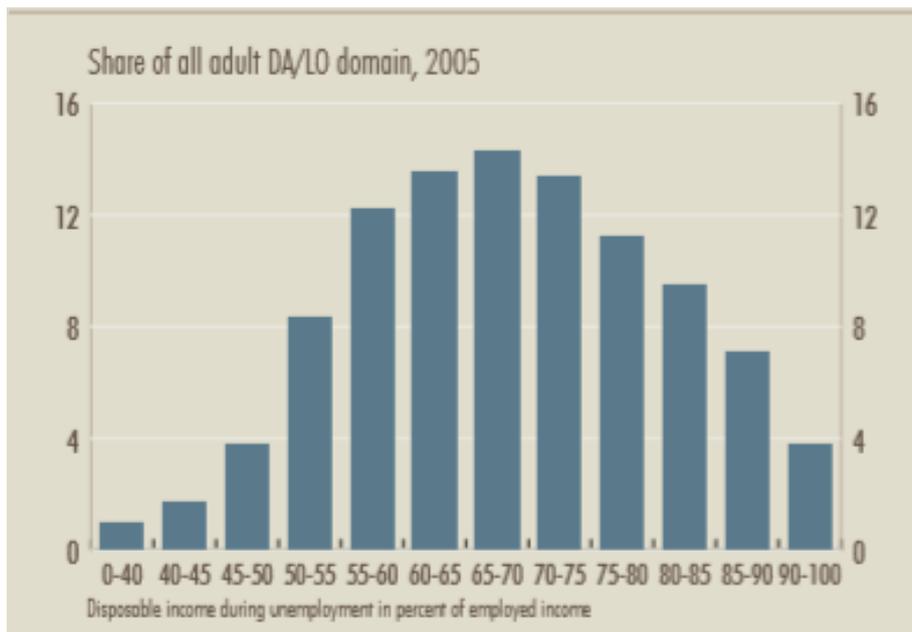
It can be said that the active labour policies are fundamental to secure employability so, reduce the unemployment. (Andersen & Mailand, 2005; Confederation of Danish Employers (DA), 2008)

7. Another important factor of the Danish system is the income security; as already introduced before, the government provide high unemployment benefits.

Even though the unemployment rate is quite low in Denmark, there is a big part of population who is outside the labour market and it is still in the working age. The problem is that the employment system is not able to face all the labour market demand and low paid jobs are decreasing for various reasons. This can be a problem for low skilled people such as refugees and immigrants who are completely outside from the labour market.

Apart from the continuing training and education that is a good opportunity to replace persons in the labour market, the income compensation is highest respect to other countries. In particular, the benefits are higher for low income groups.

Figure 5.10: Degree of coverage of unemployment.



SOURCE: (CONFEDERATION OF DANISH EMPLOYERS (DA), 2008)

The Figure 5.10 shows how with a low income the compensation is 90% of the employed income, on the other side with a high income the benefits count for the 40%.

Anyway, the high level of compensation is fundamental for the acceptance of the ease and flexibility of firing employees. (Andersen & Mailand, 2005; Confederation of Danish Employers (DA), 2008)

8. The Combination security is possibility to combine paid employment with other forms of activities and obligations such as training and maternity. This contributes to create a flexible labour market where the employees can participate to civic activities and then return to ordinary job. (Andersen & Mailand, 2005; Confederation of Danish Employers (DA), 2008)

This short analysis shows that the flexicurity model is a complex system with various and different factors and each one contributes to maintain the perfect balance allowing the entire system to work properly. Moreover, the social cohesion and cultural values contributes to the system.

## Conclusion

Denmark represents absolutely an advanced country with a complex system of innovation and welfare.

The country has a strong economy and during the financial crisis it has not suffered so much if compared to other European countries, probably due to its structure, able to face instantly the new challenges.

At first glance, the entire system seems to be simple and easy to imitate through the replication of the organisation structure, but the analysis reveals that it is the result of various factors both economic, political and social.

Moreover, as confirmed by the statistics presented on the third chapter, the interaction between companies, institutions, universities and research organisations is higher respect to other countries. This helps to create a matrix system where all the players collaborate and create a dynamic and flexible eco-system able to face and answer to the new challenges.

Denmark, as other Nordic countries, has an important public sector both in terms of employment and involvement, that is well managed and plays a crucial role on social and economic aspects. The government is involved in a continuous process of improvement in order to adapt the system to the new challenges and to obtain a better and more efficient use of resources. This confirms the high dynamism of the system and the institutions involved.

Innovation Fund Denmark represents one proof of this constant improvement process. It was created in 2014 as a merger of other three institutions to offer a more integrated strategy and more effective projects with the same level of investments.

Moreover, the government, conscious of the internationalisation and globalisation of businesses and companies, has started to develop a network of offices abroad, the innovation centres. They are becoming crucial to innovate and create new value and for this reason, the government is opening year by year new offices in strategic countries where new opportunities can be exploited by Danish companies and also education organisations that can increase their internationalisation effort.

This dynamism and flexibility is not just a characteristic of the national system, but also of the local and regional environment. This is extremely important, and it reveals how

Denmark has an integrated structure at all levels able to face new challenges and identify new opportunities and solutions. This is difficult to imitate.

In addition, the government is thinking about a furthermore level of responsibilities for the municipalities. This decentralisation strategy, started in 2007, seems to work properly even if a strong national strategy is still needed to drive the municipalities in the right direction. It can be an advantage for large municipalities, but it can be a disadvantage for small ones who has not the dimensions to face all these new responsibilities. In the next years, it will be said if this strategy was the right path or not, but what it can be noticed now is that the first step, started in 2007, is working fine.

The Regional Growth Forums are one of the main results of this decentralisation strategy. They are implemented for each of the five regions and they represent the key player for the creation and the maintenance of growth in each region, developing and monitoring the regional strategy and taking in consideration the recommendations of the national government.

Another example, Invest in Odense, illustrated in the third chapter, shows the dynamism and the flexibility of the municipality of Odense. When the major companies within the city closed and went abroad, following the main trend of the new millennium and leaving the economic context compromised, the municipality has created Invest in Odense in order to attract new investors, move the city to new economies concentrating the economic efforts on the new business trends such health care and drones, but involving the entire city environment, from the enterprises to the university. The latter is considered crucial in this effort, it provides knowledge for companies and it provides new employees with high qualifications to answer to the new labour demand that has new needs and ask for new competences.

Invest in Odense has replicated at the regional level what started with the national Invest in Denmark because they believe that when you attract new investors in Denmark then, it is necessary to have a local institution to show the local environment, to guide the investors in the local territory and to convince them that it is the right place, underling more the local characteristics and advantages in order to carry out successfully the investments.

The analysis revealed how Denmark has an advanced education system, continuously under development, and how the government has increased the funds for research,

considered crucial for the development and growth of the country. In 2006, the government issued the University Act that transformed the university as independent institutions with more autonomy and responsibilities. Moreover, the decision to merge various universities, especially one faculty institutes, in fewer bigger institutions seems to be a right solution to increase the cross collaboration among faculties that can give new opportunities of growth. Anyway, it is too early to judge this strategy, everything is still recent, but in my opinion, it can help in various aspect such as the cross collaboration, but also the internationalisation of the universities.

The universities, as other public institutions, are dynamic in the environment and the Research Innovation Organisation is the main proof to this dynamism. Its creation is recent, and some teams were already present in Southern Denmark University, but the university management decided to merge all the teams in a unique organisation to integrate better them and boost the collaboration among them. These eight teams carry out different activities, but they are correlated so, they must collaborate to reach better and fast results.

One of the team of this organisation that raise interest and attention on the analysis is the incubator SDU Cortex Lab, now called Entrepreneurship Lab. It was created in 2016, so one year before Research Innovation Organisation in the main campus of Odense and then implemented in all other campuses. It does not offer any kind of financial help, but it just helps to develop and implement the idea of students and find investors if the idea seems to be profitable. An interesting point is that the incubator sometimes helps the students to “fail” rejecting their projects. The failure is not only seen as negative, it is also seen as a positive step of the personal growth. They help students to develop the idea and understand if it is profitable or not, accelerating this process because they do not want that they lose months on a failing project. In this way they learn and they are ready to undertake another project, they want that the students try and understand that a “failure” is not the end, but it is part of the personal growth path to develop something that works and it is profitable.

Denmark has demonstrated to have a clear and well-developed lifelong learning strategy. One of the aims is build a strong knowledge society early as possible because knowledge is a precondition for growth and prosperity. The national strategy is well connected to the labour market, it represents one of the key factors of the labour

because this allows to increase the qualification of workers so, it helps the companies to be more innovative. This also reduces the unemployment because it allows to increase the competitiveness of the workforce and adapt it to the new labour demand. Nowadays, lifelong strategy is crucial for several aspects.

For what concerns the labour market, Denmark is characterised by the flexicurity model so, flexibility for employers and security for employees and this contributes to increase the mobility in the labour market allowing to bring new competences and increase the knowledge flows in the business environment. As confirmed by recent studies, it seems to have positive effects on innovation and growth.

The active labour policies and unemployed benefits are fundamental with this kind of flexibility for employers, creating a balance between the two sides of the labour market. The trade unions are the main players in this system. In a labour system with a low regulation, it can be said that they regulate the labour market establishing agreements able to satisfy the employers and employees at the same time ensuring employment, growth and flexibility.

In general, even if it seems to be marginal, the confidence on the system and on responsible regulations seems to play a key role on the entire system. Denmark has a well-defined strategy and organisation that contribute to have an efficient system of innovation, at national and regional level, able to ensure growth and prosperity to Danish society.

## Annex A: Definitions of indicators of the European Innovation Scoreboard.

INDICATOR	DEFINITION NUMERATOR	DEFINITION DENOMINATOR	INTERPRETATION
	Source	Source	
2.3.4 Community designs per billion GDP (in PPSE)	Number of new community designs applications	Gross Domestic Product in Purchasing Power Standard	A design is the outward appearance of a product or part of it resulting from the lines, contours, colours, shape, texture, materials and/or its ornamentation. A product can be any industrial or handicraft item including packaging, graphic symbols and typographic typefaces but excluding computer programs. It also includes products that are composed of multiple components, which may be disassembled and reassembled. Community design protection is directly enforceable in each Member State and it provides both the option of an unregistered and a registered Community design right for one area encompassing all Member States.
	Office for Harmonization in the Internal Market	Eurostat	Comment: two-year averages have been used
3.1.1 SMEs introducing product or process innovations (% of SMEs)	Number of SMEs who introduced a new product or a new process to one of their markets	Total number of SMEs	Technological innovation, as measured by the introduction of new products (goods or services) and processes, is a key ingredient to innovation in manufacturing activities. Higher shares of technological innovators should reflect a higher level of innovation activities.
	Eurostat (CIS)	Eurostat (CIS)	
3.1.2 SMEs introducing marketing or organisational innovations (% of SMEs)	Number of SMEs who introduced a new marketing innovation or organisational innovation to one of their markets	Total number of SMEs	The Community Innovation Survey mainly asks firms about their technological innovation. Many firms, in particular in the services sectors, innovate through other non-technological forms of innovation. Examples of these are marketing and organisational innovations. This indicator captures the extent that SMEs innovate through non-technological innovation.
	Eurostat (CIS)	Eurostat (CIS)	
3.1.3 Employment in fast-growing enterprises in innovative sectors (% of total employment)	Employment in fast-growing enterprises in innovative sectors is calculated through sector-specific innovation coefficients, reflecting the level of innovativeness of each sector, serving as a proxy for distinguishing innovative enterprises. These coefficients are weighted with sectoral shares of employment in fast-growing enterprises, providing an indication of the dynamism of fast-growing firms in innovative sectors. Fast-growing enterprises are defined as firms with average annualised growth in number of employees of more than 10 % a year, over a three-year period, and with 10 or more employees at the beginning of the observation period (period of growth).	Total employment	This indicator provides an indication of the dynamism of fast-growing firms in innovative sectors as compared to all fast-growing business activities. It captures the capacity of a country to transform rapidly its economy to respond to new needs and to take advantage of emerging demand.
	Eurostat	Eurostat	

INDICATOR	DEFINITION NUMERATOR	DEFINITION DENOMINATOR	INTERPRETATION
	Source	Source	
3.2.1 Employment in knowledge-intensive activities (% of total employment)	Number of employed persons in knowledge-intensive activities in business industries. Knowledge-intensive activities are defined, based on EU Labour Force Survey data, as all NACE Rev.2 industries at 2-digit level where at least 33% of employment has a higher education degree (ISCED5 or ISCED6)	Total employment	Knowledge-intensive activities provide services directly to consumers, such as telecommunications, and provide inputs to the innovative activities of other firms in all sectors of the economy.
	Eurostat	Eurostat	
3.2.2 Exports of medium and high-technology products as a share of total product exports	Value of medium and high-tech exports, in national currency and current prices. High-tech exports include exports of the following SITC Rev.3 products: 266,267, 512, 513, 525, 533, 54, 553, 554, 562, 57, 58, 591, 593, 597, 598, 629, 653, 671, 672, 679, 71, 72, 731, 733, 737, 74, 751, 752, 759, 76, 77, 78, 79, 812, 87, 88 and 891	Value of total product exports	The indicator measures the technological competitiveness of the EU i.e. the ability to commercialise the results of research and development (R&D) and innovation in the international markets. It also reflects product specialisation by country. Creating, exploiting and commercialising new technologies are vital for the competitiveness of a country in the modern economy. Medium and high-technology products are key drivers for economic growth, productivity and welfare, and are generally a source of high value added and well-paid employment.
	Eurostat (ComExt) for MS, UN ComTrade for non-MS	Eurostat (ComExt) for MS, UN ComTrade for non-MS	
3.2.3 Knowledge-intensive services exports as % of total services exports	Exports of knowledge-intensive services are measured by the sum of credits in EBOPS (Extended Balance of Payments Services Classification) 207, 208, 211, 212, 218, 228, 229, 245, 253, 260, 263, 272, 274, 278, 279, 280 and 284	Total services exports as measured by credits in EBOPS 200	The indicator measures the competitiveness of the knowledge-intensive services sector. Knowledge-intensive services are defined as NACE classes 61-62 and 64-72. These can be related to the above-mentioned EBOPS classes using the correspondence table between NACE, ISIC and EBOPS as provided in the UN Manual on Statistics of International Trade in Services (UN, 2002).
	Eurostat	Eurostat	
3.2.4 Sales of new-to-market and new-to-firm innovations as % of turnover	Sum of total turnover of new or significantly improved products, either new to the firm or new to the market, for all enterprises	Total turnover for all enterprises	This indicator measures the turnover of new or significantly improved products and includes both products which are only new to the firm and products which are also new to the market. The indicator thus captures both the creation of state-of-the-art technologies (new to market products) and the diffusion of these technologies (new to firm products).
	Eurostat (CIS)	Eurostat (CIS)	
3.2.5 License and patent revenues from abroad as % of GDP	Export part of the international transactions in royalties and license fees	Gross Domestic Product	Trade in technology comprises four main categories: Transfer of techniques (through patents and licences, disclosure of know-how); Transfer (sale, licensing, franchising) of designs, trademarks and patterns; Services with a technical content, including technical and engineering studies, as well as technical assistance; and Industrial R&D. License and patent revenues capture disembodied technology exports.
	Eurostat	Eurostat	

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