UNIVERSITA' DEGLI STUDI DI PADOVA
DIPARTIMENTO DI SCIENZE ECONOMICHE E AZIENDALI
"MARCO FANNO"

CORSO DI LAUREA MAGISTRALE IN ECONOMIA INTERNAZIONALE
LM-56 Classe delle lauree magistrali in SCIENZE DELL'ECONOMIA

Tesi di laurea

INNOVATION POLICIES: A COMPARISON BETWEEN NORDIC COUNTRIES AND CHINA.

Relatore:
Ch.Ma Prof.ssa BELUSSI FIORENZA

Laureanda:
CASARI ELENA

Matricola N: 1103677

Anno Accademico 2015-2016

TABLE OF CONTENTS

INTRODUCTION

The work here presented aims to define the main differences in innovation policies between the Nordic countries (Sweden, Finland and Norway) and China, the differences in their economic backgrounds and the challenges that these different areas are facing to achieve the biggest part of market share.

In the first chapter there's a deep explanation of the concept of innovation: how is it born, why is it so relevant, how is it possible to innovate, focusing then to the European context and the innovation impact on it. In this framework, the presence of Government in supporting the innovation process is essential. It is considered irreplaceable because it can assume risks that the private sector cannot afford. It plays the most important role in financing revolutionary technologies, which can change the ranking position of each country. Moreover, it is clear that European policies in research and innovation allow reaching the economic integration and a higher level of already existing technological relationships among firms.

In the second chapter analyses the Nordic countries' innovation policy, starting from the general area of the north and then focusing on each country. Looking at a broad-spectrum, technological advance here is characterized by an endless interaction and mutual learning between different types of knowledge and actors, including firms, institutes, universities, and sources of financing and relevant public agencies. It has been mentioned Norway just because the country is a part of the Nordic ones, but after the analysis it has been clear that actually it's not an innovation leader as the other two.

Nevertheless, they all have small economies, well-developed welfare states and organized labour markets, with a given growth to the concept of "the Nordic Model". Each country has been considered starting from basic information, actors helping to innovate and the actual situation dealing with innovation.

In the third chapter the Chinese innovation status has been studied, thanks also to Professor Niosi, who gave important information about it. China is well known as the country, which has declared its goal to become a global leader in science and technology. Indeed its aims are to cultivate common entrepreneurship throughout the country and to shift from labour-intensive manufacturing to innovation-driven growth. This can be realized thanks to its 13th Five-Year Plan, which goals to increase China's technology and innovation capabilities. A special attention has been given to the

Chinese National Innovation System (NIS), which makes possible to knowledge to be created and transferred; thanks to this China has realized its propensity to Grand Challenges like: Transit Elevated Bus, Quantum Experiments at Space Scale and Robots.

In the fourth and last chapter is dedicated to the comparison between the agglomeration of Sweden and Finland innovation policy (without Norway) and China's one. Starting with the background analysis, in which it is quite obvious to notice the great difference between them due to a dissimilar economic history. The dissimilarity is clear in their innovation policies, cluster construction and the authorities that take place in their realization. Both Nordic countries are performing above the EU average, but even if they have the best outcomes among European countries, they are not omitted from challenges. Therefore they thought at special projects in order to improve their actual situation. China, with its request to be recognised as a Market Economy and its label of "Made in China" is struggling to acquire a valuable title of Leader in innovation. For China, more can be gained by following a long-term, coherent strategy to build its own capabilities than by attempts to accelerate technology transfer in an artifice way.

CHAPTER 1

THE RELEVANCE OF INNOVATION

1.1 The concept

The concept of innovation is probably Schumpeter's most distinctive contribution to economics. One of the most common theme in his writings was the role of innovation ("new combination") and entrepreneurship in economic growth [1]. Schumpeter was the first introducing the modern idea of innovation. In his view, the Evolutionary theory plays a crucial role and the elements of the economic development are: reason (innovation), actor (entrepreneurs) and means (financial resources). He departs from Marx in making a deliberate attempt to develop a theory of how innovations are created. First of all he adds a definition of innovation (or "development" as he initially phrased it) as "new combinations" of existing resources, equipment and so on. This "combinatory" activity he labels "the entrepreneurial function". Innovation, he argues, needs to be distinguished from an invention, which is a discovery and a prescriptive knowledge. This means that it concerns with the discovery process that is irrelevant by the economic point of view. The reason Schumpeter stresses this difference is that he sees innovation as a specific social activity (function) carried out within the economic sphere and with a commercial purpose, while inventions in principle can be carried out everywhere (such as, for instance, in universities), and without any intent of commercialisation[2]. Innovation is a specific social activity achieved in the economic filed with a commercial aim, thanks to a innovative entrepreneur and his typical characteristics must be: intelligence, alertness, energy and determination. According to Schumpeter, it's not necessarily an entrepreneur who receives profit, but surely it is created entirely thanks to him. There are many factors, working at the individual, group and social level that make success in innovation a very challenging task. There's of course the economic bonus associated with successful entrepreneurship in capital society, which, although transitory in nature, may nevertheless amply reward those who succeed. The Schumpeter's innovation and

[1] Karol Śledzik, Schumpeter's view on innovation and entrepreneurship.

[2] Jan Fagerberg, Schumpeter and the revival of evolutionary economics: an appraisal of the literature, Journal of Evolutionary Economics.

entrepreneur concept is universal and still evolving in principles of Neo-Schumpeterian economics. Indeed, his words have never seemed so appropriate as nowadays, when modern capitalism is experiencing a serious crisis and has lost his strength. Entrepreneurship is innovation and the actualization of innovation. It's a proportional knowledge, which creates a Creative Destruction. It refers to the incessant product and process innovation mechanism by which new production units replace out-dated ones. The process of Schumpeterian creative destruction (restructuring) permeates major aspects of macroeconomic performance, not only long-run growth but also economic fluctuations, structural adjustment and the functioning of factor markets. At the microeconomic level, restructuring is characterized by countless decisions to create and destroy production arrangements. These decisions are often complex, involving multiple parties as well as strategic and technological considerations. The efficiency of those decisions not only depends on managerial talent but also hinges on the existence of sound institutions that provide a proper transactional framework[3]. The word innovation comes from the Latin "innovare", and is all about change and the processes of creating value from ideas[4]. Innovation is creating new value and/or capturing value in a new way. This means that value is the key word in this topic, stressing the difference between innovation and invention. It helps providing the difference, making something faster, cheaper and with more features. An innovation is an idea that has been transformed into practical reality. It also thought as a process of creating value from ideas. We can change products and services that we offer, the way we create and deliver them. This means to create a change: the value created in terms of product or service, is not only commercial but also social. For a business, this is a product, process, or business concept, or combinations that have been activated in the marketplace and produce new profits and growth for the organization. Changes in processes or products are made in order to create value. This may be defined in terms of creating a product or service which others find useful and which they value. Innovation allows you to see potential acquisitions through a different lens, looking at them not just from a cost perspective, but also as a means of accelerating profitable top-line revenue growth and enhancing capabilities. It also provides an edge in being able to enter new markets faster and deeper. The speed and efficiency of the diffusion of innovation through the economy is critical to productivity and

[3] http://economics.mit.edu/files/1785

[4] Wiley, Strategic Innovation Management

economic growth. It can be pictured as a cascade process. Through the forces of competition and imitation, an initial innovation is developed and improved so that the impact on the economy is many times greater than that brought about by the first application of the innovation[5]. An important difference that has to be underlined is how innovation can be defined and the different forms of innovation can be classified in several ways:

→ *Product Innovation* which consists of changes in product attributes with a change in how the product is noticed by consumers.

→*Process Innovation* which consists of changes regarding the product or the service production process. It does not necessarily have an impact on the final product but produces benefits in the production process, generally increasing the productivity and reducing costs.

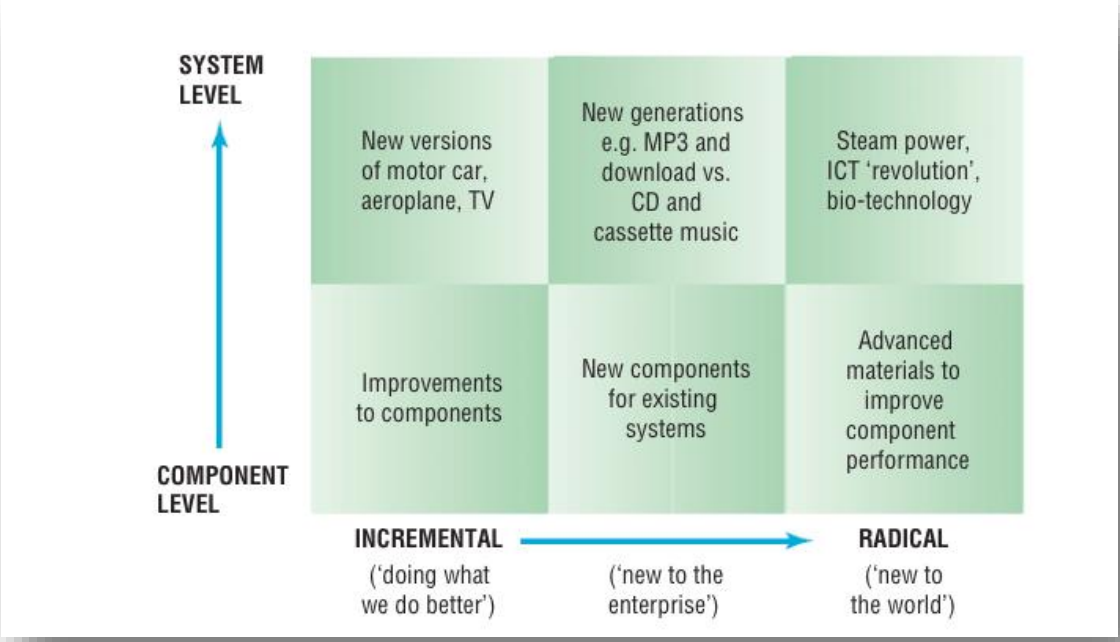
Another differentiation is that one between the incremental and radical innovation:

→ *Incremental Innovation* which reflects small continuous improvements in products or product lines. It generally represents small improvements in benefits noticed by the consumer and it does not change significantly the business model or the way the product is consumed.

→*Radical Innovation* which represents a drastic change in the way that the product or the service is consumed. It generally, brings a new paradigm to the market segment that modifies the existing business model.

[5] Communication from the commission to the council, the European Parliament, The European economic and social committee and the Committee of the Regions.

Figure 1: Types of innovation



Source: Strategic Innovation Management, Wiley

It's important to underline the relevance of another type of innovation, which is the New Technological paradigm. It denotes the concretization of solving the existing technological and economic problems, based on the highly selective principles and a new concept of efficiency for an organizational model on the level of the basic production unit and a new model of managing a firm. Techno-economic paradigm represents a group of technical and economic characteristics of a certain technological solution, which is constantly being improved, thus becoming more coherent and complex, with a strong influence on forming all parts of great economic system. That is a general model which operatively leads to the intensive process of generating the innovations of products and processes. In contemporary conditions, the term techno-economic paradigm substantially incorporates common characteristics, complementarities, or mutual links of several partial paradigms related to semiconductors, computers, industrial automation, robots, etc[6].

[6] Slobodan Cvetanović, Danijela Despotović, Igor Mladenović, The concept of technological paradigm and the cyclical movements of the economy

1.2 Why does Innovation matter?

One of the keys to any successful business is being able to come up with new ideas to keep operations, products and services fresh. The process of bringing those ideas to reality is called innovation. The majority of business professionals agree that innovation is critical to their success. A recent study by Accenture revealed that more than 90% of executives believe long-term success of their organization's strategy depends on their ability to develop new ideas. Innovation has the ability to add value to company's products, differentiating it, even temporarily, in the competitive environment[7] . Innovation is even more important in markets with plenty of commodities, such as the ones presenting a high level of competition and whose products are roughly equivalent between competitors. It's about survival and growth and this regards the whole economy. Regional and national governments spend a great deal of money trying to stimulate and support innovation in different ways. Too often, small business owners avoid innovating because they associate it with a huge investment in technology, plant and equipment. But probably they don't know that some of the most profitable innovations are small. Sometimes a small innovation creates a win for both company and customers. Indeed, it is necessary for a company to make innovation part of the culture and the mission statement and to create a process for innovation[8]. The company that builds a culture of innovation is on the path to growth. That one which fails to innovate is on the road to obsolescence. Innovation creates customers by attracting new users and building stronger loyalty among current ones. By putting innovation at the centre of the business, from top to bottom, it's possible to improve the numbers; and at the same time, to discover a much better way of doing things: more productive, more responsive, more inclusive, even more fun. People want to be part of growth, not endless cost cutting, even if collaboration is essential, failure is a regular caller. Of course the stages before problem solving are important – exploring, reshaping and redefining the problem makes a difference. Sometimes the challenge is to look beyond the apparent pattern. We've evolved to be really good at making sense out of multiple information fast, and this because survival depended on it. So how do we go about problem-exploring? How do we move from ambiguous notions, half ideas towards something

[7] Chad Brooks, Innovation: Key to Successful Business, Business News Daily Senior Writer

[8] http://www.insme.org/news/whats-new/171

more workable? Effective innovators need a variety of skills to help them create value from ideas[9]. But they are comfortable with uncertainty and have an open mind; they are receptive to ideas from very different disciplines. They've organized innovation into a disciplined process that is replicable. And, they have the tools and skills to identify and manage the risks inherent in innovation. Those who innovate in this context, either doing incremental or radical, product, process or business model innovations, are at an advantage over the others. Not everyone has these attributes, but companies cannot build a culture of innovation without cultivating people who do. Successful innovators are concerned to develop dynamic capabilities, in order to change their approaches. Companies need to be active in this context, especially exploiting research's results and contributing to EU's competitive growth. Of course it's a complex process, which can be realised in different ways, as a matter of fact we know that it's a kind of chain: from it we end up to have input and feedback. For this reason it's very significant an efficient system able to share information, transform them in knowledge and differentiate it in internal and external. Clearly, the benefits of innovation are not limited to the companies. Innovations allow countries and regions to increase the level of employment and income, as well as the access to the globalized world. Innovations offer new products that now have more benefits of the products offered. Innovation has to be seen as a social process, in order to succeed, companies need to see innovation not as something special that only special people can do, but as something that can become routine and methodical, taking advantage of the capabilities of ordinary people. Enterprises are spurred to innovate by pressures and challenges, notably competition and the desire to create new market space. In general, companies are at the centre of innovation. It is through them that technologies, inventions, products and ideas arrive to the market. The vast majority of large companies have entire areas dedicated to innovation, presenting research and development (R&D) laboratories that have several researchers. Despite this central role played by the companies, the interaction between partners is essential, but without it, the innovations are vulnerable. These partners have diverse functions, from conducting external research and development of products and processes, to the implementation of investments or subsidies, going through prototype development, market research and production scheduling[10]. Innovation is vital to

[9] A.G. Lafley and Ram Charan; The Game Changer, April 2008

[10] http://bgi.inventta.net/en/innovation/

European competitiveness in the global economy. The EU is implementing policies and programmes that support the development of innovation to increase investment in research and development, and to better convert research into improved goods, services, or processes for the market[11].

1.3 How to innovate?

To perform innovations, it is necessary for the companies to be aware of the importance of innovation in the existing competitive scenario. There is no way to become an innovative company without giving proper attention to the subject. The typical managers' question is "How do I find innovative people for my organization? And how can I become more innovative myself?" The problem is that most of us know very little about what makes one person more creative than another. A Five-Step Innovation Process can be helpful to answer to these questions:

1. Define the problem very clearly. Often it can happen that there's no a clear idea of the change that you're trying to make, it's harder to think about the solutions.
2. Throw out as many constraints to your thinking as possible. Enter into a safe area where you don't have constraints, where you feel like you're not being judged, where you can throw out all the constraints to your thinking. The thing is to be with a group of people whom you know and with whom you can be creative. The only thing to do is to throw out constraints to general thinking and put yourself in a very comfortable environment.
3. Ensure those working to solve the problem are deeply passionate about solving the problem. There's a need to find people who are deeply passionate and who deeply care about finding that solution and have more than simply an economic incentive. It takes that kind of passion to drive them to think differently than other people.
4. Ideate in small groups. This means to combine the best creative thinkers with the domain experts in an environment that is set up to throw out constraints, amazing solutions can emerge. During the brainstorming phase, capture all ideas regardless of how silly they are and don't start evaluating or critiquing ideas until you've finished the brainstorming phase. Take a look at the steps of the design thinking

[11] http://ec.europa.eu/growth/industry/innovation_en

process (Empathize, define, ideate, prototype, test). Go wide, and then narrow ideas down for prototyping and testing. Create an incentive competition that provides prizes for the best innovation. Find ways to create incentive competitions and provide prizes for the innovation you're looking for[12] .

At the same time, we can identify five "discovery skills" that distinguish the most creative executives:

1. Associating: the ability to successfully connect seemingly unrelated questions, problems, or ideas from different fields;
2. Questioning: "The important and difficult job is never to find the right answers, it is to find the right question";
3. Observing: Discovery-driven managers produce uncommon business ideas by examining common phenomena, particularly the behaviour of potential customers. In observing others, they act like social scientists;
4. Experimenting: Like scientists, innovative entrepreneurs actively try out new ideas by creating prototypes and launching pilots
5. Networking: Devoting time and energy to finding and testing ideas through a network of diverse individuals gives innovators a radically different perspective, they make a mindful effort to visit other countries and meet people from other walks of life.

We found that innovative entrepreneurs (also CEOs) spend 50% more time on these discovery activities than do CEOs with no track record for innovation[13]. Innovative entrepreneurs have something called *creative intelligence*, which enables discovery yet differs from other types of intelligence. It's important to underline how there is no way to become an innovative company without giving proper attention to the subject, which is innovation. The most important skill to practice is questioning. Asking "Why" and "Why not" can help turbocharge the other discovery skills. Ask questions that both impose and eliminate constraints; this will help to see a problem or opportunity from a different point of view. As a matter of fact, innovative entrepreneurship is not a genetic predisposition, it is an active effort. What make a

[12] Ryan Allis, How to Innovate, The Startup guide

[13] Jeffrey H. Dyer Clayton M. Christensen, The Innovator's DNA, Harvard Business Review 2009

company truly innovative? Beyond the geographical and sectorial diversity, there are three crucial aspects that this kind of company has in common:

- They combine innovations

  Whereas previous generations of technology pioneers focused on introducing new technologies as such, pioneers especially in 2016 are increasingly combining technologies. 3D printing, big data, the internet of things, advanced satellites imaging and drones are innovations of the Fourth Industrial Revolution that are reconstituting various industries and sectors.
- They innovate at an ever increasing step

  Some innovations today are reduced to be obsolete in a matter of years or even months. Conversely, some companies that were founded only a few years ago are leaders in their fields. That contrasts with the past, when truly ground-breaking innovations took years or even decades to spread. The first industrial revolution, with its steam power and the rise of the factory system, took almost 80 years to develop, while the more recent computer revolution also progressed slowly.
- They work on solutions to global challenges

  Companies have long faced criticism for chasing profits at all costs, without taking into account the larger challenges the world is facing. Today, with the world at a tipping point in terms of climate change and other challenges, that narrow corporate perspective is changing. Many of today's technology pioneers believe these global challenges need addressing[14] .

At the same time, in order to create innovation, competition appears to be as important as price competition as a reaction by enterprises to market pressures. In many business sectors, an enterprise that allows itself to hold-up behind in the race to generate new or improved goods and services, and better ways to produce or run them, is putting its future on the line. In such fast-moving sectors it is the new enterprises with growth potential that are often the most innovative, forcing established enterprises to respond to the challenge by themselves becoming more innovative. Encouraging the emergence of new firms is a strong force for innovation in many sectors.

[14] Fulvia Montresor, These 3 things make a company truly innovative, World Economic Forum

While research is a major contributor to innovation, if there is no entrepreneurial action there is no value creation. It is the enterprise that organises the creation of value. For enterprises, innovation is a crucial means to create competitive advantage and superior customer value. Except for certain types of technology-based enterprises, the focus is not on technological aspects of new product development, but on innovative ways to improve their position in the market. Innovation also matters to a range of what we might call 'policy agents' – organizations, which have a broader concern with innovation. These include: governments (local and national): innovation creates economic growth, jobs, etc., so fostering innovation becomes a key issue; trade and sector bodies: their interest is in stimulating innovation to make for sector health and competitiveness; supply chain 'owners': any supply network is only as strong as its weakest link, so it makes sense for firms to try to manage their supply systems and upgrade them. As we've seen, innovation is not simply a random process but rather a sequence of planned experimentation. This is the difference between the Darwinian idea of survival of the fittest and the way innovation works; in the latter case the variation is planned and designed. It is still risky and may not succeed but it is a purposive activity[15]. Enterprises must adapt better, take advantage of change, regularly renew and redirect their activities and show a stronger entrepreneurial orientation. There's the need of recognising the full scope of the innovation phenomenon and develop a better knowledge of how it works in the European environment in order to put public policy on a firm foundation.

1.4 Has the government to support the innovation process?

Innovation is one of the efforts that has to be taken into account by companies. It is promoted in order to increase productivity and delay inflation or to improve the international competitiveness of a nation's products and improve its balance of payments position (record of transactions between a country and the rest of the world). Firms innovate to produce technologically improved products or services and in order to do this, they need to assume innovation activities, which are all those scientific, technological, organizational, financial and commercial steps (including investments in new knowledge). Government intervention is needed to manage the problems, and is expected to increase innovation in the industry. Government's influence on all elements of the innovation process may be significant and it

[15] Wiley, Strategic Innovation Management

should assume risks and has a long-term vision in order to fix market failures. Innovation concerns not only the entrepreneur but also the whole society. It's a social phenomenon, which involves all actors: entrepreneurs, lenders and public administrators. The government should oblige everybody to assume the responsibility to realize a new innovative system, indeed the external knowledge is a really important input in the production of new knowledge and this role has been recognised and incorporate in the innovation system's approach. Usually universities are solicited to patent their discoveries and forced to enter the market of services of technological research. The role of Universities in the research and commercialization is very important, indeed there has been an increase in technology-based economic development initiatives in order to stimulate patents, licenses and creation of start-up. This provide a relevant consequence in the way in which Universities commercialize and diffuse development technologies in their labs such as potential for promoting technology commercialization and generation revenue for university. But they can't do this by themselves; they need help which mean funds. Government must help in order to support the new developments through changes in the regulatory environment and often industries take the role of universities in developing training and research at the same high level as universities. Many governments' interventions seek to increase the efficiency of industrial processes and to stimulate innovation. The interaction between Government programs and innovation is very wide-ranging and Government influences on all elements of the innovation process may be significant. Moreover governments may choose to intervene where markets forces are clearly unable to achieve defined national objectives and this intervention has become more involved and more intense during these two past decades. Of course they are not concerned with technological innovation for their own sake, but they rather try to promote it or to manage it because of the social, economic and political effect. In conclusion, Government is considered irreplaceable in promoting innovation because it can assume risks that the private sector cannot afford. It plays the most important role in financing revolutionary technologies which can change the ranking position of each country[16].

[16] http://www.oecd.org/science/inno/39374789.pdf

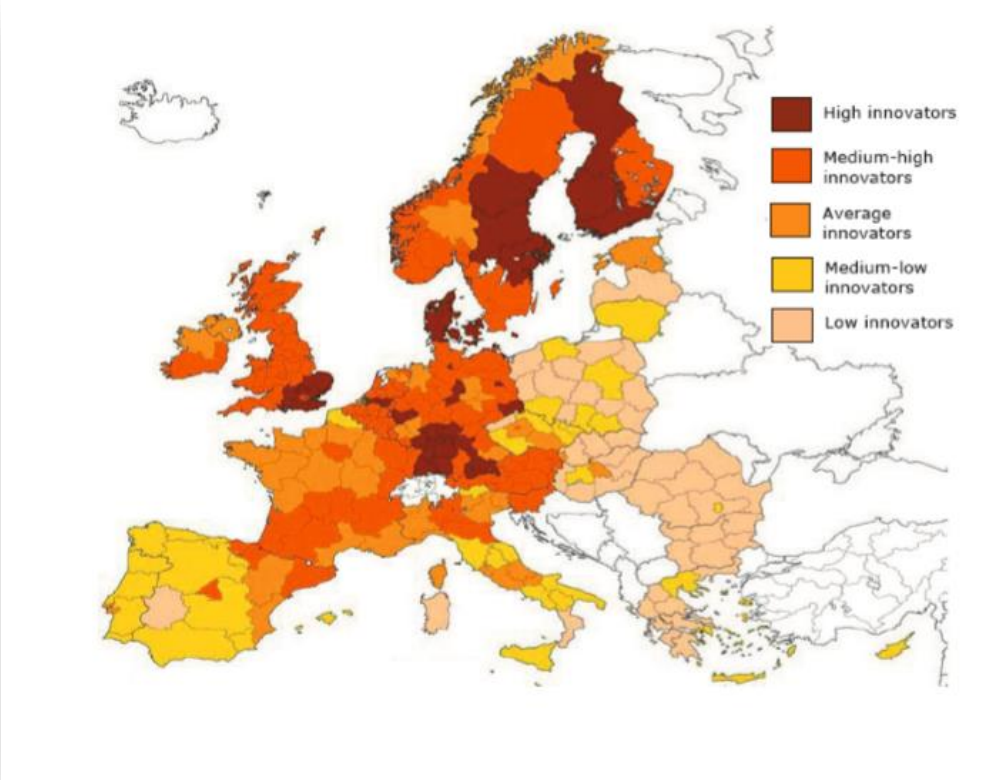
1.5 European Innovation policies

Europe is facing a structural problem of 'innovation stagnation', indeed the recent Innovation Scoreboard 2009 has shown positive signs in some regions, but overall innovative investments by businesses still appear to be relatively weak, especially if compared to the US and Japan. Europe must focus on unlocking its full innovation potential in the years to come, to the benefit of EU citizens. Europe must realise that innovation patterns around the world are changing and pose new challenges to the old continent's ability to compete internationally. The point is that the EU is still very fragmented when it comes to innovative potential and output. The recent European Innovation Scoreboard 2009 has highlighted that EU member states can be divided into at least four different groups:

- Innovation leaders: Denmark, Finland, Germany, Norway, Sweden and the UK;
- Innovation followers: Austria, Belgium, Cyprus, Estonia, France, Ireland, Luxembourg, the Netherlands and Slovenia;
- Moderate innovators: Czech Republic, Greece, Hungary, Italy, Lithuania, Malta, Poland, Portugal, Slovakia and Spain;
- Catching-up countries: Bulgaria, Latvia and Romania[17]

[17] Maria Anvret, Massimiliano Granieri, Innovation Policy: Boosting EU competitiveness in a global economy, CEPS Task Force Report

Figure 2: Regional Innovation performance in the EU



Source: European Innovation Scoreboard, 2009.

Innovation is a cornerstone of the "Lisbon strategy" launched by the European Council in March 2006, and emphasised by subsequent European Councils. It has been created the Lisbon Monitoring Platform (LMP) in order to create a community, which sustain growth and development, in order to make easier the flow of information. This strategy will be efficient thanks to a better governance. This platform allows the dynamic exchange of political ideas and good practises among the members, increasing the cooperation and the implementation of: innovation, research and sustainable development. In this context it's important to underline the relevance of education and the possibility to let researchers the free mobility to acquire new knowledge. The protection of Intellectual Property is certainly significant for innovation, the lack of protection to inventors and their inventions won't stimulate the will to invest in them. A "European Patent" would be a really great improvement in this setting, because it would let the system to be more efficient. Also clusters would help to fill the gap between business and resources, producing more knowledge and quicker to the market. They increase productivity, attract investments and promote research, for these reasons they become also a fundamental point for the development of different capabilities. Clusters can

attract brilliant scientists who support innovation (typical example is Silicon Valley). This is the reason why district policies are becoming fundamental in the Europe innovation policies. Important though research is as the source of invention, innovation includes more than the successful application of research results. The evolution of the innovation concept - from the linear model having R&D as the starting point to the systemic model in which innovation arises from complex interactions between individuals, organisations and their operating environment - demonstrates that innovation policies must extend their focus beyond the link with research. While innovation policy takes place mostly at the national and regional levels, the Member States and the Commission need to intensify their cooperation for the strengthening of innovation in the EU, including coordination and assessment mechanisms for mutual learning, as well as for taking stock of progress achieved. Improving innovation is a cornerstone of the strategy to meet the target agreed by the European Council of the Union becoming the most competitive and dynamic knowledge-based economy by the end of the decade [18]. The importance of innovation policy is widely recognised. It is also strongly linked to other EU policies, such as those on employment, competitiveness, environment, industry and energy. The role of innovation is to turn research results into new and better services and products in order to remain competitive in the global marketplace and improve the quality of life of Europe's citizens. In addition, some brain drain effect occurs as our best researchers and innovators move to countries where conditions are more favourable. Although the EU market is the largest in the world, it remains fragmented and is not sufficiently innovation-friendly. With a view to changing these trends, the EU has developed the concept of an 'Innovation Union', which is a crucial investment for our future and it aims to:

- Make Europe a world-class science performer;
- Remove obstacles to innovation — like expensive patenting, market fragmentation, slow standard-setting and skills shortages — which currently prevent ideas getting quickly to market;
- Revolutionise the way the public and private sectors work together, notably through the implementation of Innovation Partnerships between the European institutions, national and regional authorities and business.

[18] Communication from the commission to the council, the European Parliament, The European economic and social committee and the Committee of the Regions.

The Innovation Union is one of the seven top initiatives of the Europe 2020 strategy for a smart, sustainable and inclusive economy. Launched by the European Commission in October 2010, it aims to improve conditions and access to finance for research and innovation in Europe so that innovative ideas can be turned into products and services that create growth and jobs. The Innovation Union aims to create a genuine single European market for innovation, which would attract innovative companies and businesses. To achieve this, several measures have been proposed in the fields of patent protection, standardisation, public procurement and smart regulation. The Innovation Union also aims to stimulate private sector investment and proposes, among other things, to increase European venture capital investments. Several instruments have been introduced to measure and monitor the situation across the EU and the progress being made:

→ *A comprehensive Innovation Union Scoreboard* based on 25 indicators and a European knowledge market for patents and licensing. The European Innovation Scoreboard (EIS) is a European Commission instrument developed under the Lisbon Strategy to provide a comparative assessment of the innovation performance of EU Member States;
→ A *Regional Innovation Scoreboard* (RIS), which classifies European regions into four innovation performance groups, similarly to the Innovation Union Scoreboard (as we have already seen previously). It provides a more accurate mapping of innovation at local level;
→ The *Inno-barometer* is an annual opinion poll conducted among businesses and the general public on attitudes and activities relating to innovation policy. The Inno-barometer survey provides policy-relevant information, which is not available from other sources[19].

The Innovation Union also aims to create an open single European market for innovation, which would attract innovative companies and businesses. To achieve this, several measures are proposed in the fields of patent protection, standardisation, public procurement and smart regulation. Furthermore, the Commission has drawn up a strategy to strengthen European standardisation, in which it highlights the need to improve the method for setting standards and the use of standards in Europe in order to leverage European and international standards in the interests of the long-term competitiveness of European industry. Are there benefits for

[19] http://www.europarl.europa.eu/atyourservice/en/displayFtu.html?ftuId=FTU_5.9.7.html

the citizens? The initiative will lead to breakthroughs to improve the quality of life and create jobs. The Innovation Union means:

- A smarter economy to support our standard of living
- Better use of public money
- Empowering citizens thanks to social innovation
- Finding solutions to help us live longer and healthier lives
- A greener Europe

Europe and its Member States and regions need to act together in partnership to help innovation flourish. While Member State can change their education systems to foster a more qualified work-force, the EU has a role to play in terms of coordinating the actions put forward in the Innovation Union initiative to make sure things unite well[20].

1.5.1. Funding for innovation: Horizon 2020

To accelerate the modernisation of the EU industry, use of innovative manufacturing technologies and introduction of new business models is necessary. The Commission develops policies that help speed up the broad commercialisation of innovation and engages in many activities that support innovation in the EU mainly through the Horizon 2020 programme. This is the biggest EU Research and Innovation programme ever with nearly 80 billion euro of funding available over 7 years (2014 to 2020) – in addition to the private investment that this money will attract. It promises more revolutions, discoveries and world-firsts by taking great ideas from the lab to the market[21]. Horizon 2020 is the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness. It has the political backing of Europe's leaders and the members of the European Parliament. Everybody agrees that research is an investment in our future and so it's relevant through them to create sustainable and inclusive growth and jobs. The combination helps this programme to achieve great results in industrial leadership and attempting societal challenges. Its aim is to ensure Europe produces world-class science, removes barriers to innovation and make it easier for the public and private sectors to work

[20] European Commission ,Innovation Union – A pocket guide on a Europe 2020 initiative
[21] http://ec.europa.eu/programmes/horizon2020

together in delivering innovation. Horizon 2020 enacts many of the specific Innovation Union commitments, notably by focusing on real challenges facing society, simplifying access, involving SMEs, strengthening financial instruments, supporting public procurement of innovation, facilitating collaboration, and supporting research on public sector and social innovation. There must be a strong entrepreneurial orientation among management and staff if enterprises are to show a kind of dynamic capability. Policy should help to promote entrepreneurial behaviour. The EU Framework Programme for Research and Innovation will be completed by further develops the European Research Area (ERA), an open space for knowledge and growth. This will allow breaking down barriers in order to create a genuine single market for knowledge, research and innovation. The 5 fundamental aims to reach within 2020 are: employment, innovation, education, social inclusion, environment/ energy and this will be possible through:

1. Excellent Science with 24.598 billion euro budget, in order to guarantee the first place to Europe in the scientific field;
2. Industrial Leadership with 17.938 billion euro budget, in order to sustain research and innovation in the European industry;
3. Social Challenges with 31.748 billion euro budget, in order to face global challenges in different fields like Health, Nutrition, Safe Energy and Transportation.

But who can take place in this programme? Who is allowed to participate? The programme is available for everybody and it has a very easy structure thanks to cut in timing, which will allow to get information and financing easily and so focus on the realization of projects. Universities, companies, Research Centres can participate to the project, they just need to have some special requirements. There are three main "dimensions" to the policies impacting on the innovation terrain. Policies to foster innovation and entrepreneurship share common ground with industrial policy and, if successful, generate the constant regeneration that permits industry to overtake in growth and competitiveness.

1. The "policy governance" dimension: policy influencing the innovation capabilities and behaviour of enterprises may be set at local, regional, national, EU or even global level. Coherence and complementarity between the different levels is clearly essential.
2. The sectorial dimension: many factors affecting innovation are common to all industrial sectors, although their relative weight will differ according to the characteristics of each sector. Some sectors, however, such as information and communication technologies,

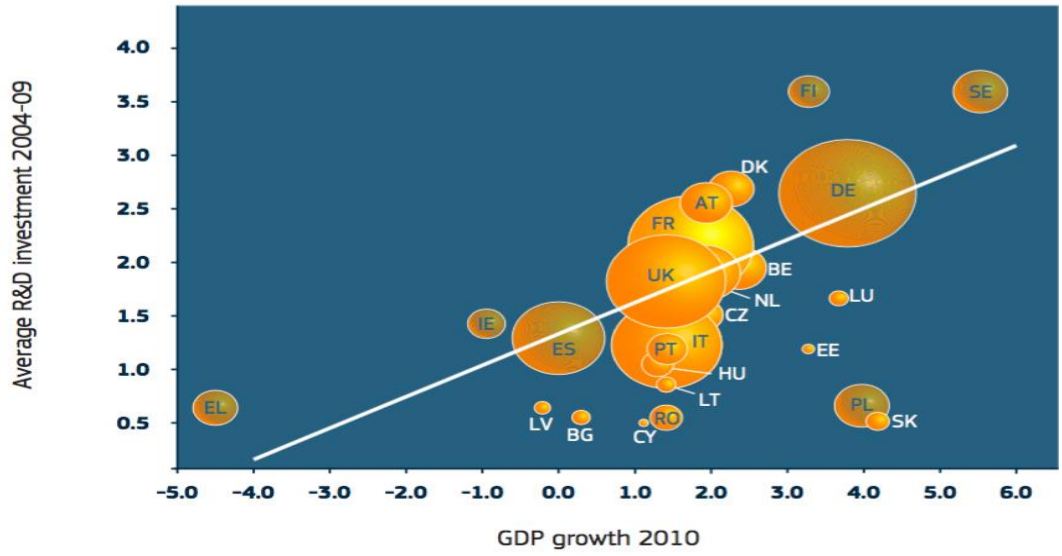
the textile industry and biotechnology, have highly specific characteristics and therefore face specific issues that may require a policy response.

3. The interaction with other policy areas: innovation policy must often be implemented via other policies, to take account of the diversity of factors influencing innovation by enterprises[22].

Achieving the goal of an Innovative Europe requires a new paradigm of mobility, flexibility and adaptability in order to allow R&D and innovation to create the value that can then support our quality of life. The paradigm shift cannot be confined to the narrow domain of R&D and innovation policy, important though that is. Simultaneous and synchronous efforts are needed at all levels in three areas: creation of a market for innovative products and services; providing sufficient resources for R&D and innovation; and improving the structural mobility and adaptability of Europe[23]. For companies, the principal barrier to investment in Europe is the lack of an innovation friendly market. In particular, the fragmentation of markets across the national boundaries of Member States provides a major disincentive for innovation. Despite progress towards the Single Market and some notable successes, the reality for most innovators remains that they face an obstacle course of multiple levels of regulations and requirements, each of which raises costs and lowers incentives. By comparison, the large national markets of the USA and increasingly of China provide a more fertile ground in which to launch innovations. Europe must gear its Internal Market to foster a transition to the knowledge-based economy[24].

[22] Communication from the commission to the council, the European Parliament, The European economic and social committee and the Committee of the Regions.
[23] http://www.eua.be/Libraries/research/aho_report.pdf?sfvrsn=0
[24] Esko Aho, Report of the independent Expert Group on R&D, Creative an innovative Europe

Figure 3: R&D investments in Europe 2004-2009



Source: European Commission

1.5.2. Impact of innovation in the European background

The political attention on industry is grounded in the realisation that a strong industrial base is essential for a wealthy and economically successful Europe. It is vital to stimulate economic recovery, provide high-quality jobs and reinforce our global competitiveness. Since it is through enterprises that the economic benefit of the successful exploitation of novelty is captured, the enterprise is at the heart of the innovation process. Innovation policy must have its ultimate effect on enterprises: their behaviour, capabilities, and operating environment[25] Industry can generate the high productivity growth needed to restart sustainable growth: industrial productivity rose by 35% since the worst times of the crisis in 2009. Moreover, only industry can improve economy-wide energy- and resource-efficiency in the face of global resource scarcities and help provide solutions to societal challenges. Industry is crucial for EU competitiveness and innovation is a key factor in this esteem. Industry accounts for 80% of Europe's exports. Some 65% of private sector research and development (R&D) investment comes from manufacturing. Nevertheless, the continuing economic crisis has put Europe's industry under pressure: production is 10% lower than before the crisis and over 3 million industrial jobs have been lost. Consumer and business confidence are low. Problems in the

[25] Politica dell'innovazione: aggiornare l'approccio dell'Unione europea nel contesto della strategia di Lisbona, EUR-Lex

banking sector make it difficult to access finance. This is happening at a time when the speed of innovation and technological development has put the world on the edge of an industrial break-through. Several new technology areas are converging to lay the foundation of the new industrial revolution based on green energy, clean transport, new production methods, novel materials and smart communication systems. These will change the global industrial landscape and our competitors in the U.S. and Asia are investing heavily in these areas. New investment is now urgently needed to stimulate economic recovery and bring innovation and new technologies back onto factory floors. If Europe does not keep up with investment in the adoption and diffusion of these technologies, its future competitiveness will be seriously compromised. Europe needs new industrial investment at the time when lack of confidence, market uncertainty, financing problems and skills shortages are holding it back[26]. Therefore, industrial modernisation in Europe must be broad reaching and include: the successful commercialisation of product and service innovations the industrial exploitation of innovative manufacturing technologies innovative business models. European policies in research and innovation allow reaching the economic integration and a higher level of already existing technological relationships among firms: these technological bonds imply an higher integration. Moreover, the evolution in technology force to develop technologies, which need the collaboration of more countries together, nobody can afford to invest alone in such hard fields. The European approach is a kind of tool that let grow the whole system. The speed and efficiency of the diffusion of innovation through the economy is critical to productivity and economic growth. It can be pictured as a cascade process. Through the forces of competition and imitation, an initial innovation is developed and improved so that the impact on the economy is many times greater than that brought about by the first application of the innovation. The process requires the constant reallocation of resources to activities that lead to more efficiency or greater economic value, so that the occupational and geographical mobility of the workforce is an important factor for innovation. Leaders in technology development are not necessarily leaders in technology adoption. The most important economic contribution does not necessarily come from the "early adopter" but from the "fast follower" who adopts

[26] Communication from the commission to the council, the European Parliament, The European economic and social committee and the Committee of the Regions, A Stronger European Industry for Growth and Economic Recovery Industrial Policy Communication Update

the innovative design that captures the international market. Studies show that those companies who prioritise innovation are also those who experience the highest increase in turnover (Innobarometer, 2014): Some 79% of companies that introduced at least one innovation since 2011 experienced an increase of their turnover by more than 25% by 2014. Small and medium-sized enterprises (SMEs) are a particular target for innovation policy. The smaller the company is, the more it faces constraints to innovation or to the commercialisation of its innovations. Some 63% of companies with between 1 and 9 employees declared having introduced at least one innovation since 2011, compared to 85% of companies with 500 employees or more. Some 71% of companies with between 1 and 9 employees encountered difficulties commercialising their innovations due to a lack of financial resources, compared to 48% of companies with 500 employees or more.[27] The substantial progress in managing the link between research and innovation, and integrating innovation promotion in EU research policy, should be complemented by examination of other policy interfaces at EU level relevant to the climate for innovation by enterprises. National statistical offices should be encouraged in their efforts in collecting and providing comparable statistical data in the area of innovation. The Commission will increase the coherence of the various on going policy benchmarking exercises that fall under the competence of the Competitiveness Council (European innovation scoreboard, enterprise scoreboard, science and technology key figures). Improved innovation statistics also have to be coherent with international standards in order to allow meaningful comparisons with other major economic areas in the world. In Finland, for example, the Science and Technology Policy Council is responsible for the strategic development and coordination of science and technology policy as well as of the national innovation system as a whole. Lead by the Prime Minister, it comprises seven other ministers and ten members representing stakeholders in innovation. Another example of such an "innovation council" structure is in Portugal, where the government has set up PROINOV, the Integrated Programme for Innovation, with a coordination structure involving five ministries dealing with policies related to innovation under the chairmanship of the Prime Minister. The Union must recognise the full scope of the innovation phenomenon and develop a better knowledge of how it works in the European environment in order to put public policy on a

[27] http://ec.europa.eu/growth/industry/innovation_en

firm foundation[28].

1.5.3. A better governance for innovation: European and local

Governance refers to the systems and practices that governments use to set policy priorities and agenda, implement policies and obtain knowledge about their impacts and effectiveness. These governance systems and practices are in a permanent state of flux reflecting the changes in the political and societal systems that the policies interact with[29]. As the motive force for innovation, the enterprise operates among a range of influencing factors subject to manipulation, to varying degrees, by public policy. Innovation is founded on the enterprise's ability to recognise market opportunities, its internal capabilities to respond innovatively, and its knowledge base. There must be a strong entrepreneurial orientation among management and staff if enterprises are to show this kind of dynamic capability. There are three main "dimensions" to the policies impacting on these components of the innovation environment. They also figure as factors to be taken into consideration in the debate on industrial policy in an enlarged Europe. Policies to foster innovation and entrepreneurship share common ground with industrial policy and, if successful, generate the constant regeneration that enables industry to outperform in growth and competitiveness. Firstly, the "policy governance" dimension: policy influencing the innovation capabilities and behaviour of enterprises may be set at local, regional, national, EU or even global level. Coherence and complementarity between the different levels is clearly essential. Secondly, the sectorial dimension: many factors affecting innovation are common to all industrial sectors, although their relative weight will differ according to the characteristics of each sector. Some sectors, however, such as information and communication technologies, the textile industry and biotechnology, have highly specific characteristics and therefore face specific issues that may require a policy response. Thirdly, interaction with other policy areas: innovation policy must often be implemented via other policies, to take account of the diversity of factors influencing innovation by enterprises. Innovation concepts must be increasingly embedded in many

[28] Community Guidelines on state aid to support risk capital investments in SMEs of 19.07.2006, http://ec.europa.eu/comm/competition/state_aid/others/risk_capital_guidelines_en.pdf

[29] Mari Hjelt, Pim den Hertog, Robbin te Velde, Mikko Syrjänen, Major challanges for the governance of national research and innovation policies in European countries, Tekes

policy areas[30]. Commission notices the significance of a long-term strategy based on an agglomeration of all actors who are in the system, acting all together. All the efforts combined by everybody will lead to the innovation of our society; indeed a political leadership is needed for a structural change. In order to realise these aims a new governance structure is vital, this should let to reach a multilevel innovation, thanks to national coordinated mechanisms, which check the application of the different innovation strategies. But also the presence of the single private actor is relevant in order to create an innovative system; he has to feel involved in this topic[31]. Moreover, as the European Council claims, a Strategy for Innovation and Good Governance at Local Level is a practical and needed instrument consisting of twelve principles aiming at improving the governance at the local level and the quality of citizens' life as a result. The Strategy was launched in 2007, in Valencia (Spain), by the European Ministers responsible for Local and Regional Government and then endorsed by the Committee of Ministers of the Council of Europe in 2008. A Council of Europe's Stakeholders' Platform directs this instrument and a European Label of Governance Excellence (ELoGE) is awarded to local authorities having achieved a high overall level of governance and implementing the Strategy. This is a practical instrument which can be used to generate synergies between all the stakeholders, be they local, regional, national or European, by working together with common instruments for improving the quality of local governance according to a shared vision defined by the twelve Principles of good democratic governance[32]. The aim of the Strategy is to activate and stimulate action by national and local stakeholders so that citizens in all European countries benefit from good democratic governance at the local level, through the continuously improving quality of local public services, engagement of the population and policies that meet their legitimate expectations. The scope of a good governance is the fact that it's a requirement at all levels of public administration. At local level it is of fundamental importance because local government is closest to citizens and provides them with essential services and it is at this

[30] Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions - Innovation policy: updating the Union's approach in the context of the Lisbon strategy

[31] European Commission, COM (2006) 502 final, 13.09.2006

[32] http://www.coe.int/t/dgap/localdemocracy/Strategy_Innovation/Strategy_Brochure_E.pdf

level that they can most readily feel ownership of public action[33].

1.5.4. From standardization to innovation

Standardization policy has been a key element of EU innovation and competitiveness policies since the launch of the Single Market Initiative in 1985. A standard is a document that provides, inter alia, requirements, rules and guidelines for a process, product or service. These requirements are sometimes complemented by a description of the process, products or services[34]. The process of formulating, issuing and implementing standards is called standardisation The actual European standardization system has to adapt to the speed of markets' movement, especially in services and high technology. The European Union should be more active in influencing the global standardized systems. When we talk about standardization, we refer to that voluntary process for development of specific techniques based on the common agreement: industries but also public authorities. At the international level, there are three different organisations: International Organisation for Standardisation (ISO), International Electro technical Commission (IEC) and International Telecommunications Union (ITU). They don't have organic collections with the European level, but they have signed different cooperation agreements. Here the question is: how standardization can contribute to innovation? Quite often, standardization and innovation are considered in contrast, cause innovation isn't thought as something that can exist with different conventional ways within well defined and common standards. Commission claims how innovation often needs new standards in order to create new products and services. These standards are vital in terms of safety, quality and respect of the environment; but not just technical ones but also management, which can supply internal organization schemes (quality authentication). Of course there are negative aspects which can imply an obstacle to the access of innovation by the market. This is the case of specific technological standards: they may be able to stop the access of new technologies to the market. Standardization has a strategic value, both for public interest and private one, even if many governments don't feel to be involved in the issue, that's why many times standardization activities are ignored.

[33] Extract from the Valencia Declaration 15th Conference of European Ministers responsible for local and regional government (Valencia, Spain, 15-16 October 2007)
[34] Maria Anvret, Massimiliano Granieri, Innovation Policy: Boosting EU competitiveness in a global economy, CEPS Task Force Report

Education needs to have a primary role to modify this kind of situation focusing on a long term strategy (for example introducing these topics in universities, offering exchanges with Chinese partners, who are already busy with them). In conclusion, analysing every aspect and problem of standardization, we can get different topics to think about and to develop in further system's reforms[35]

1.5.5 Current challenges for EU innovation policy

Public policy making could be considered as a set of processes, including the setting of the agenda and the specification of alternatives from which a choice is to be made. Two categories of factors might affect these two processes: the participants who are active (inside and outside the government), and the processes by which agenda items and alternatives come into prominence. Regarding the latter processes a distinction is made between problems, policies and politics[36]. The aim of the innovation phenomenon and the universal nature of innovation policy are not the only challenges faced by European innovation policy. The economic, social and political context poses equally significant challenges for policy makers. The Union's structures, problems and opportunities relating to innovation are not necessarily the same as those faced in other major economic areas of the world. Many states that compete strongly with the Union in global markets are implementing strategies to boost innovation that have much in common with the Lisbon strategy. The EU will have to work hard just to retain its present relative position. To attain the Lisbon goal of being the most competitive requires us to step up a gear. Moreover, the resistance to structural change that is frequently faced in Europe must be overcome when it stands as an obstacle to innovation, especially when change is resisted because it challenges existing procedures that people have become accustomed to. However, it must be tolerated that the European innovation display focuses on high technology innovation. Although it includes indicators for the diffusion of innovation, these are not fully adequate to capture innovation through the purchase of advanced manufacturing technology or the development of new methods of production and delivery, as occurs in sectors characterised as "low" or "medium-low" technology. A further challenge for the Union, therefore, is to develop an innovation display with a more satisfactory coverage of

[35] http://www.eu2006.fi/news_and_documents/conclusions/vko50/en_GB/1165932111543/
[36] Mari Hjelt, Pim den Hertog, Robbin te Velde, Mikko Syrjänen, Major challanges for the governance of national research and innovation policies in European countries, Tekes

innovation in all its forms. Innovation requires that entrepreneurship be encouraged by policies that take into account the different patterns of entrepreneurship that are pertinent in different countries and regions. European diversity brings with it different aspirations and attitudes to innovation that have to be respected. Attitudes are especially likely to be nuanced when innovative developments have a social impact. The full and genuine participation of all stakeholders in the innovation process, including the public at large, needs to be ensured. In brief, the challenge is to develop a specifically European approach to innovation policy that will constitute a path to improved economic growth[37]. Here the question is: are there new directions for European innovation policy development? Several new directions should be addressed as ways in order to improve innovation performance:

1. Interaction with other policy areas to improve the environment for innovative enterprises
2. Stimulate greater market dynamism and exploit the concept of lead markets
3. Promote innovation in the public sector
4. Strengthen the regional dimension of innovation policy.

Having a common platform for research is the mean to create important synergies between different national programs, concentrate an adequate amount of resources attracting also private investments, have priorities at a EU level, avoiding waste and duplication. But the loss of competitiveness is something that we have to solve, if we want to avoid sliding into a spiral of economic and social decline, deindustrialization and inevitable political unrest. The European engine runs too slow because we have been unable to keep bound with the changes and meet the challenges put forward by the new global world. It's an utopia to think that Europe will successfully compete with China, India or Brazil on quantity or products with little added value. In order to return to a steady and concrete growth, Europe must aim at high value-added products that are incomparable in quality and innovation, and linked to research and technological development; able to address problems of sustainability and resource efficiency following global demographic and industrial growth. R&D, innovation and training are the real winning card that, together with less naïve commercial policies, more

[37] Communication from the Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions - Innovation policy: updating the Union's approach in the context of the Lisbon strategy

transparency and checks on finance, greater internal market integration, and an industrial policy that keeps up with the challenges of the new millennium, can prevent the European decline. Since the Lisbon Strategy, the emerging countries have gone from 1/5 to 1/3 of global wealth production; and continue to grow also in sectors with high intensity in knowledge and technology. The number of Chinese researchers had already outstripped the European one in 2008, with a yearly growth rate of 10% compared to 3% in the EU. Politics has to acknowledge these trends and ground the new European Strategy for Research and Innovation on a forceful change of route with more applied research and development and selective investments. Stimulating private research with a new European juridical regime for venture capital, subsidized loans and fiscal incentives. Politics must take the responsibility to make focused and well-timed choices so that Europe can defend its technological leadership maintaining industrial roots and jobs; and safeguarding the European Social Model. In conclusion, there's a need of a more political Europe aiming at boosting competitiveness through the strengthening of the economic governance for a common strategy on Research and innovation[38].

[38] Antonio Tajani, Innovation, an insight from Europe, European Commission

CHAPTER 2

NORDIC COUNTRIES' INNOVATION POLICY

2.1. Nordic context

The European Union is the world's leading trading power, but the world economy is changing rapidly and becoming increasingly multipolar. The major emerging economies (Brazil, Russia, India and China) continue to grow quickly, and most of them have put in place ambitious industrial policies with a strong focus on technologies and industrial innovation in order to move towards greener production. From the mid 1990s onwards, all of the Nordic governments have introduced the idea of innovation systems as a new policy field39. During the 1990s the high profile concept of innovation was introduced, a concept that everyone immediately wanted to use for somewhat different ends and it was pioneered by scientists, legitimised by the OECD, sanctioned and endorsed by the EU through the Lisbon strategy, and more or less welcomed by all policy makers in the nation states of Europe. In the EU context it has only recently been recognised that innovation policies are about non-linear systems while thus far they have generally been regarded and governed as linear processes even in the Nordic countries. The movement from a linear to a more systemic approach to the governance of innovation is however now emerging in the Nordic countries. Innovation policies in the Nordic countries are all strongly influenced by the so-called systemic approach to innovation. According to this view, technological advance is characterized by constant interplay and mutual learning between different types of knowledge and actors, including firms, institutes, universities, and sources of financing, relevant public agencies and more. Innovation is no longer understood as a linear process, where inventions are born in the universities to be transferred to industry. It is now apparent that policy makers must consider other factors that research when developing new policies, including for instance incremental improvements of products, processes and services, organizational change, company learning processes, and the use of design, branding and marketing[40]. The linear way of thinking about

[39] Communication from the commission to the European, the council, the European economic and social committee and the committee of the regions, A Stronger European Industry for Growth and Economic Recovery Industrial Policy Communication Update

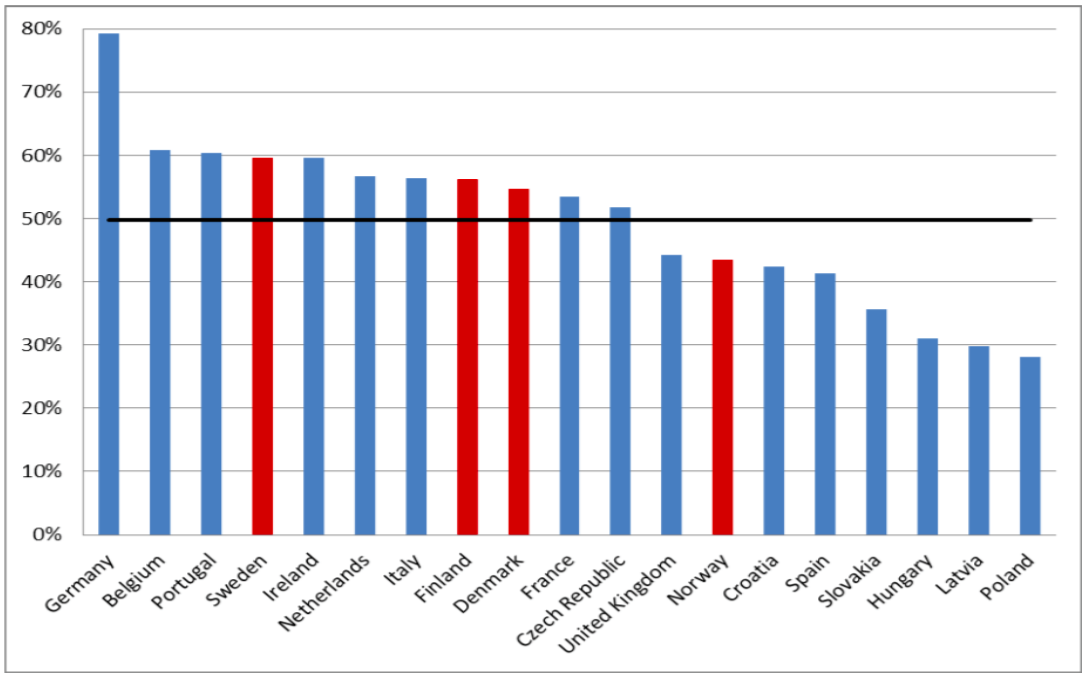
[40] Per M. Koch, Innovation Policy in the Nordic Countries 2004, Trend Chart Nordic

innovation, implying that innovation is developed in a research laboratory and then 'used' by a company or a community, is now being replaced by a systemic way of thinking about innovation implying a different thought. It emerges "from the quality of interactions between producers, users and mediators of knowledge in the regions: local authorities, companies, centres of production or of transfer of knowledge, local coordination institutions, bodies providing financing of SMEs or research". Common to Sweden, Finland and Norway is the idea of having "Centres of Expertise" (Centre of Expertise in Finland, VINNVÄXT in Sweden and Norwegian Centre of Expertise) that are expected to have a central role in developing regional innovation systems. These programmes have concentrated in those regions with the potential to become leading growth centres[41]. The Nordic countries share a number of distinguishing features. They all have small economies, well-developed welfare states and organized labour markets, with a given rise to the concept of "the Nordic Model". In recent years the models have attracted positive global attention, since the Nordic countries have demonstrated good results in terms of growth, employment, gender equality, competitiveness, living conditions and egalitarianism when compared to other countries. This ability to combine efficiency and equality has encouraged debate in politics as well as in social research. External change in the form of increased global competition, climate problems, migration and European integration, interacting with internal change associated with an increasing, ageing and more diverse population, urbanization and rising expectations with regard to health services, education and welfare in general, will be a test of these models' resilience. Everything starts from the assumption that the Nordic countries share some characteristics regarding the territorial governance challenges, as well as territorial governance and policy styles. The main source of information on innovation will be the Community Innovation Survey (CIS) which is based on information from many thousands firms all over Europe. This information is supplemented by statics from other sources, e.g., OECD and the World Bank, on various capabilities and resources of relevance for innovation. NordMod2030 is a joint Nordic research project studying the impact that international and national development trends may have on the Nordic social models. The purpose of the project is to identify and discuss the risks and challenges that these countries will need to cope

[41] Hedin, Alexandre Dubois, Riikka Ikonen, Kaisa Lähteenmäki-Smith, Jörg Neubauer, Katarina Pettersson, Daniel Rauhut, Veli-Pekka Tynkkynen & Åke Uhlin, Regionally Differentiated Innovation Policy in the Nordic Countries – Applying the Lisbon strategy, Nordregio report.

with in the years up to 2030. The project's goal is thus to produce knowledge that can serve as a basis for designing strategies for reinforcing and renewing the Nordic social models[42].

Figure 4: Innovative Firms, 2010



Source: Authors' calculations based on Eurostat (CIS 7)

One hypothesis explaining the rather good performance of the Nordic countries in respect of innovation may be the existence of the welfare state. According to the Esping-Andersen typology of welfare regimes Denmark, Finland, the Netherlands, Norway and Sweden belong to the Social-democratic regime. (This system relies upon taxes for its maintenance, characterized by the principle of universality and favouring the public provision of free services over cash transfers). The Nordic metropolitan areas as well as almost the whole of Finland belong to the *Global Consolidation Regions* (which are on the top rung of the ladder of European innovative regions). The regions outside the major cities in Sweden are characterised as *Sustaining Competitive Advantage Regions (*are relatively strong on private technology and on learning families but much weaker in public knowledge and urban

[42] Jan Fagerberg and Morten Fosaas, Innovation and innovation policy in the Nordic region**,** NordMod 2030. Sub-report 13

services). Only the eastern part of Finland belongs to the *Entering Knowledge Economy regions* (broadly speaking 'users' rather than 'producers' of technology)[43].

Comparing the typology of four knowledge economy regions with the four main types of regions eligible for Structural Fund support suggests that if the Structural Funds were to be drawn on the basis of divergence in innovation needs and potential, the outcome would be different from that based on income per head gaps. Indeed regarding University and research, the human resources in the Nordic countries are concentrated in the metropolitan area. Not surprisingly, the leading university cities in Europe are also concentrated to capital regions and big cities. Figure 5 illustrates that several of the leading university cities are located in the Nordic Countries. Nordic university towns/cities are dis- played by their importance. Nordic universities of global or European importance are located to capitals or other major metropolis. There are, however, a number of universities not included in the index, where performance is at least of regional or national importance. Indeed the share of the population aged over 25 with tertiary level education tends to be higher in regions with a university. The regions spending most intensively on R&D in relative terms are not the capitals but the regional centres hosting a major university such as Uppsala in Sweden. However, private actors undertake the major part of the Nordic R&D effort. The public sector stands for only slightly more than 30% of the expenditure. Furthermore public R&D is mainly conducted at the universities. Norway does however have a comparably large public R&D sector. The Main Characteristics of the Nordic Innovation Systems in the different countries:

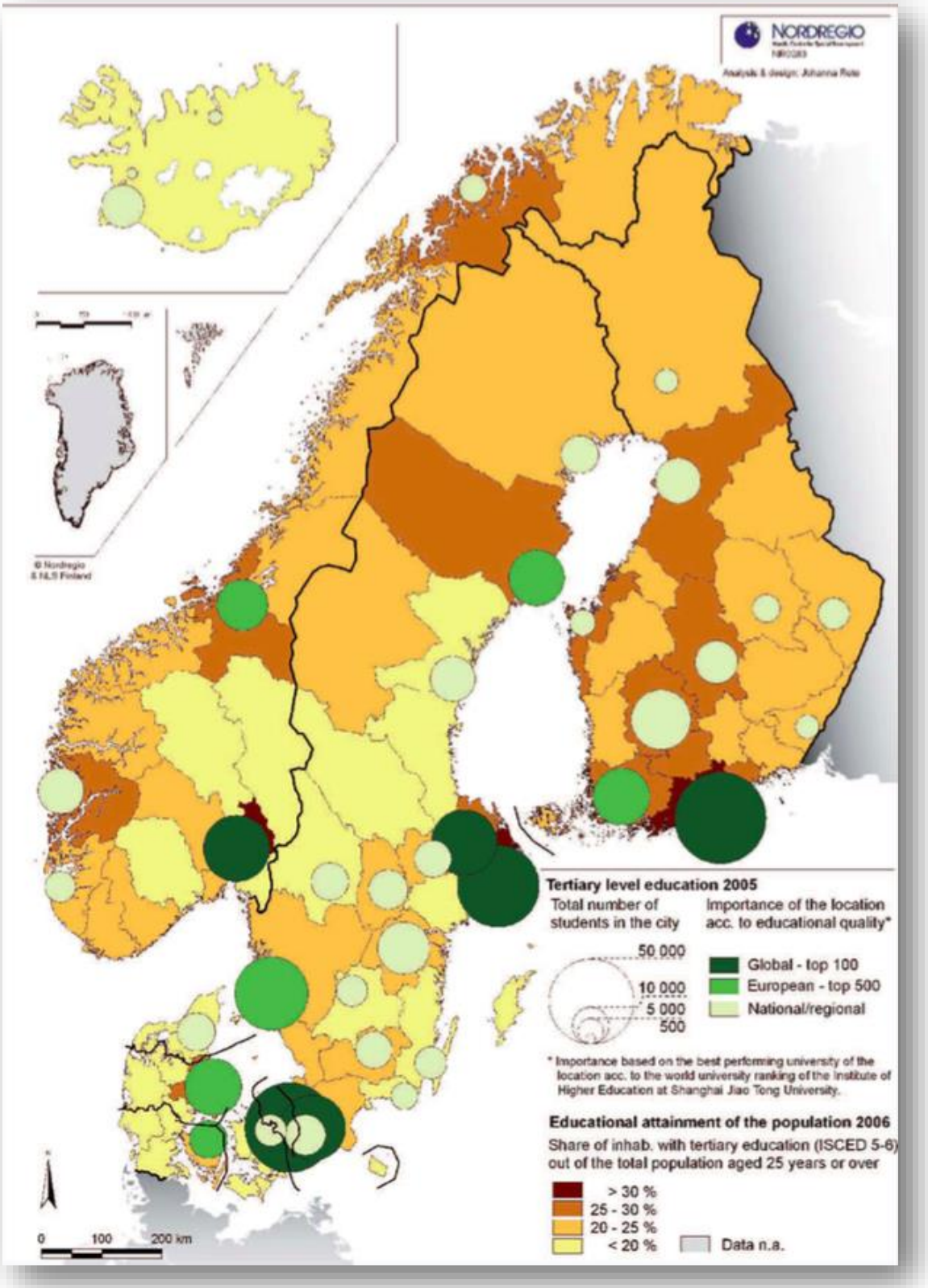
- **Sweden** is more like Germany and Japan as regards the nature of the innovation system, according to Mariussen. These countries are less entrepreneurial, but better at copying, improving and developing sophisticated support industries of mature, technologically complex products. These countries have sophisticated and advanced knowledge bases, highly developed industrial organisations, and company owners with deep interest in technological development. However, the heavy investments made in R&D, not least from the public sector, do not give as much in return as expected.
- **Finland** has, like Sweden, a process industry background with large and sophisticated national clusters in industries as wood and paper, energy, as well as support industries

[43] Per M. Koch, Innovation Policy in the Nordic Countries 2004, Trend Chart Nordic

in mechanical engineering etc. The Finish success story of "turning around and charging ahead" during the 1990s reflects the Finns' ability to adapt to new demands, without getting stuck in old industrial traditions.

- **Norway** is in many ways still relying on the early success of the 1980s, according to Mariussen. The major clusters – the marine, maritime and petroleum industries – were given strong public R&D support during the 1980s. The support industries serving these clusters are strong. This especially applies to mechanical engineering. Most Norwegian corporations are process oriented, focusing on incremental process innovation rather than new products.

Figure 5: Tertiary level education and educational attainment of the population



Source: NORDREGIO

2.2 The Nordic Countries and The Lisbon Agenda applied in their innovation policies

In all the Nordic countries, innovation systems are stimulated and developed by national policies, and for this reason a lot of different tools are used to this finale. There are however also many similarities, particularly between Norway, Sweden and Finland. The idea of having "Centres of Expertise" is a theme that runs through innovation policy instruments in these countries. Specific 'Nordic' conditions also seem to exist in respect of innovation systems: high levels of 'trust' and a low degree of formal hierarchy. The Nordic countries have an open economy and are dependent on importing and exporting goods and services from the rest of the world. The Nordic languages are spoken by few people so it is necessary to learn a foreign language and cooperate. Another denominator in the Nordic countries is the existence of their rather similar administrative organisation, i.e. parliamentarianism and a high degree of local autonomy. Additionally, the Nordic countries have historically enjoyed rather stable political systems and their educational systems are characterised by free education to the university level, which implies that university education is available for all and so the labour force will be highly skilled. The innovation policies in the Nordic countries certainly retain a rather strong focus on hi-tech industry. Traditionally the emphasis here has been on manufacturing industry rather then the service sector and this is still visible, although, there is now a discernable shift towards the latter. The usage of a slight versus a wide approach can also be connected to maturity and to the stage of innovation chain that are addressed by the policy instrument. A general movement is from technical innovation to service and social innovations, and from infrastructure and regional innovation capacity to utilisation and user-driven innovation. Across all the Nordic countries the need to transfer and to commercialise research findings has been found to be crucial in promoting competitive innovations. This interaction between research and development and the actual commercialisation of those findings in the R&D field has been named in several countries as the main 'know-how' gap on which significant future efforts should be concentrated[44].

The Lisbon Agenda denotes a stronger emphasis on innovations and gives innovation a significant role in achieving economic growth. What is needed it's the existence of a well-

[44] Jan Fagerberg and Morten Fosaas, Innovation and innovation policy in the Nordic region**,** NordMod 2030. Sub-report 13

functioning market economy, which is open to structural change. The labour force is skilled, mobile and flexible in the Nordic countries. The potential to achieve the Lisbon objectives is hopeful. The well developed welfare system and employment rules are increasingly seen as an interference to mobility and flexibility among the labour force. Another characteristic here is that the Nordic countries, historically, have been in population terms, rather homogenous. This homogeneity may also be connected to the consensus culture in most Nordic countries. A weakness in respect of such homogeneity may be that it may be difficult to include social and cultural minorities. The message found in the Lisbon Agenda is that the public sector and its actors must be prepared to leave even more assignments to private stakeholders, who can often perform such tasks more efficiently than public actors. A specific Nordic application here may be that the definition of the main objectives of the activities is political and open. But the implementation can be given to other stakeholders. This development may however be more relevant in central parts of the countries where there is competition, but may be more difficult in peripheral areas where the level of competition may be inherently weaker. A typical Nordic approach to this issue would also be to encourage innovation by different means within the public sector. For instance, innovation may be encouraged in the process of public procurement[45].

An important question in this context would be: What are the policy challenges for the Nordic Countries? In all countries there is a strong focus on innovation performance. To a certain extent this interest is reduced to a kind of innovation policy reductionism, where national R&D investments have become the significant indicator for measuring innovation. On the other hand, we can see a broader approach to innovation in many ministries and agencies, meaning a stronger focus on other indicators, entrepreneurship and productivity included, and on other forms of innovation, including branding and design. Policy makers in Norway tend to focus more on innovation in "low tech" industries than their colleagues in Finland and Sweden. Moreover, the fact that the companies in the north-western parts of the Nordic area tend to focus more on non-R&D forms of competence building and innovation also means that policy makers in this area seem to be more interested in the absorptive capacity of firms, i.e. their ability to learn and interact with other companies and institutions. However, there is

[45] Hedin, Alexandre Dubois, Riikka Ikonen, Kaisa Lähteenmäki-Smith, Jörg Neubauer, Katarina Pettersson, Daniel Rauhut, Veli-Pekka Tynkkynen & Åke Uhlin, Regionally Differentiated Innovation Policy in the Nordic Countries – Applying the Lisbon strategy, Nordregio report.

a strong interest for entrepreneurship and small enterprises in all the Nordic countries. The policies of Sweden and Finland continue to be strongly focused on the need to build new "high-tech" industries and on the role of university science. All the Nordic countries have developed new policies for the university sector (education), partly in order to improve the interaction with industry. Together with their social stability, this is probably one of the reasons behind their economic success. However, there is a general concern that the quality of the educational institutions may suffer from conservatism and a weak orientation towards the business sector. Because of this Nordic policy makers focus on topics like entrepreneurship in schools, increased focus on technology and natural science and the interaction between university and college research and industry. All countries have developed new regulations for commercialisation of university research and most of them have introduced university reforms[46]. The Nordic Council of Ministers, The Nordic Innovation Centre (NICe), The Nordic Science Policy Council (FPR) are some organizations focused on the Nordic development in collaboration at the regional level in the Nordic business sector. They basically consist of policy makers from all the Nordic countries. Policy measures are about changing behaviour in a certain direction, financial support to give opportunities, for example, creating a company or growing company, information to know more about risk and opportunity, administrative burdens to avoid certain behaviour concerning pollution or unsafe production and measures aimed at specific target groups to increase their share of the total number of entrepreneurs. If we do not want to influence behaviour we do not need any specific policy. A company's behaviour is actually about the behaviour of a number of individuals. Therefore policy measures are about changing the behaviour of individuals, whether or not their behaviour will be carried out through different legal forms or not. Policy measures are only one form of influencing behaviour and perhaps a more minor form than the influence from the business community, competitors and the so- called market[47].

The Nordic countries are all becoming more globalized than before, meaning that they will develop different, important markets and networks based upon the strength in their existing and future industry. Furthermore, many of the context indicators differ in each Nordic country

[46] Per M. Koch, Innovation Policy in the Nordic Countries 2004, Trend Chart Nordic

[47] Anders Lundström, Entrepreneurship policy in the Nordic countries – perspectives of the development since 2003

meaning that if a policy were to be built upon existing contexts we should expect Entrepreneurship policy to be different in each Nordic country.

2.3 Sweden

2.3.1. Basic information

In 2007 Sweden exceeded 9 million inhabitants, an increase mainly caused by immigration. Global changes and exogenous driving forces have had major impact on the Swedish economy. One such important external factor is China's membership in the World Trade Organisation (WTO) 2001. This institutional change was followed by a rapid growth in the Chinese economy and export, which affected the global economy. Swedish companies have answered to this by increasing their own presence in Asia. Thus, globalisation has become an even more important driving force in the Swedish economy even for SMEs, often in close interaction with the bigger players on the global market. The impact of globalisation is greater in Sweden than in many other countries due to Sweden's long tradition of open trade and extensive export/import. According to the World Economic Forum Sweden is one of the most open and free-trade-friendly economies in the world[48]. Indeed, it's part of a series of OECD country reviews of innovation policy. Two main qualities characterize the evolution of the Swedish National System of Innovation: the natural resource base in Sweden – i.e. forests and minerals – and the economic history of Sweden from the industrial revolution onwards but also the general pattern of economic development which can be summarized in terms of 'the combination of exports based on refined and processed materials on the one hand and the multinational engineering firms on the other'. In the latter half of the nineteenth century, Sweden was primarily agrarian. Its exports were dominated by products from agriculture and the mining and forest industries (iron and sawn lumber). After the mid-nineteenth century, though, new production processes allowed the export of more refined products from these industries – machinery products and pulp and paper, respectively. The engineering industry subsequently expanded significantly in terms of both employment and export shares, rising from 3 per cent of total exports in 1880 to 10.5 per cent in 1910–11, and reaching over 20 per cent in 1950. Among OECD countries, the share of manufacturing exports held by

[48] Anders Lundström, Entrepreneurship policy in the Nordic countries – perspectives of the development since 2003

engineering industries in Sweden during the 1950s was surpassed only by the USA[49]. Following the 2008-09 crisis, Sweden's economy has grown significantly faster than that of the OECD area as a whole. Sustainable economic growth will depend on Sweden's future research and innovation performance. To secure Sweden's future as a leader in research and innovation, the government's Research and Innovation Bill 2013-16 establishes a more selective, quality-based funding approach, with a significantly increased government budget for R&D[50].

2.3.2. Actors in the innovative context

The Swedish Research Council is the largest actor within the new structure, and incorporates the former three separate councils for the humanities and social sciences, for natural sciences and technology and for medicine. Also, two special research councils were set up: The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS) which encourages and supports scientifically significant research related to sustainable development; and the Swedish Council for Working Life and Social Research (FAS) which promotes the accumulation of knowledge in matters relating to working life and the understanding of social conditions and processes. Another central feature of the new funding structure is the Swedish Agency for Innovation Systems (VINNOVA), an organisation for promoting sustainable economic growth by fostering effective innovation systems and by funding research at universities of relevance to need-oriented research. Furthermore, the new structure includes a Research Forum for dialogue among researchers, research funders, the general public and others directly or indirectly concerned by the research performed. VINNOVA together with the Swedish Energy Agency and The Swedish Research Council Formas has launched a new initiative, Strategic Innovation Areas (SIA). It has also launched a related programme, Challenge-Driven Innovation (CDI) to address specific social challenges and international competitiveness through "systems innovation". In both initiatives, the actors, primarily the main end users in industry and the public sector, are

[49] Charles Edquist, Leif Hommen, Small Country Innovation Systems, Globalization, Change and Policy in Asia and Europe
[50] https://www.innovationpolicyplatform.org/content/sweden

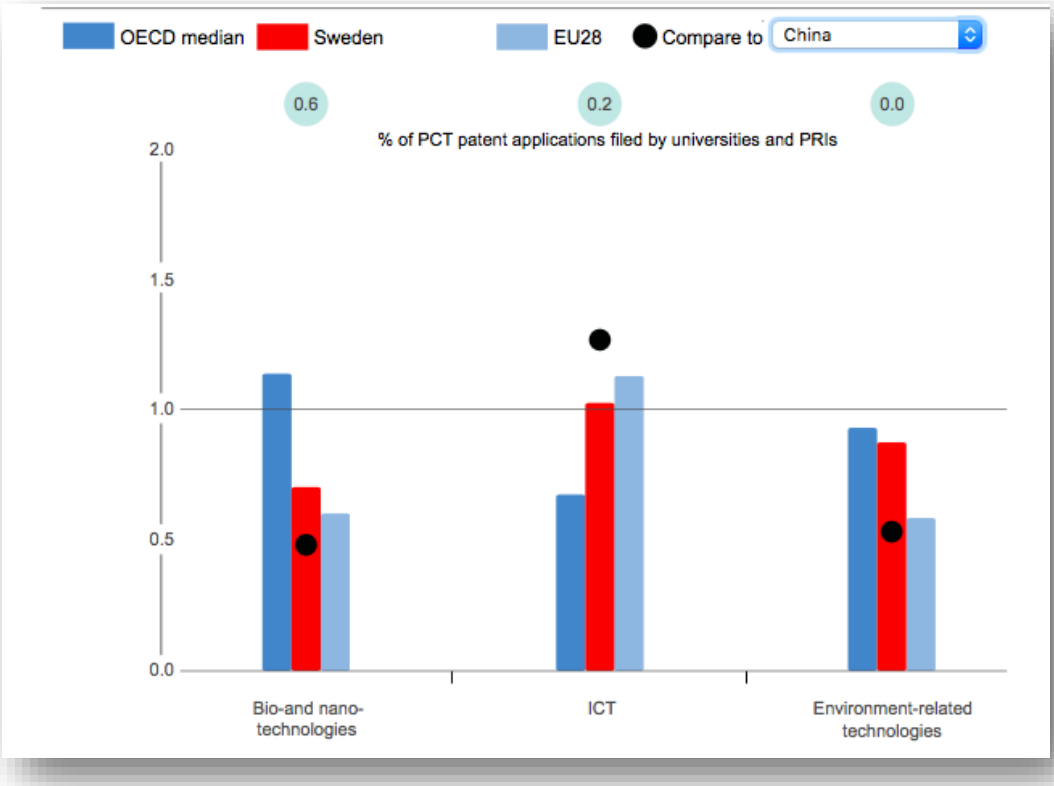
developing the agendas and defining the targets[51].

2.3.3 Technology advantage

The whole country and its capital have overtaken other European nations with a mix of unique cultural traditions, visionary tech leaders, globally oriented start-ups and smart government policies. With companies like IKEA, Spotify, Skype, Ericsson, H&M, Electrolux and Volvo, and tech leaders like Niklas Zennström (Skype), Martin Lorentzon (Spotify) and Daniel Ek (µTorrent and Spotify), Sweden is behind some of the most recognizable global brands. Between 2000 and 2014, Sweden witnessed 263 exits at a total value of $23.7 billion — leaving its Nordic neighbours Norway (75 at $10.5 billion), Denmark (58 at $7.4 billion) and Finland (91 at $6.3 billion) far behind. In 2014 alone, Sweden contributed to 50% of all exits in the Nordic region.

[51] http://www.government.se/government-policy/education-and-research/research-funding-in-sweden/

Figure 6: Revealed technology advantage in selected fields



Source: Innovation Policy Platform of Sweden

Sweden has employed innovative regulations over the years to keep its budgets balanced. According to the official government website, the government set a maximum for government expenditures in 1996 following a difficult recession.

2.3.4 Actual Situation and objective for innovation

Nowadays Sweden claims a low level of national debt, low and relatively stable inflation and a healthy banking system. The healthy state economy has given local entrepreneurs plenty of confidence to invest in companies and ideas. Moreover, Sweden actively supports local start-ups, and some discuss that the government's decision to invest in R&D is one of the driving motors of Sweden's start-up successes[52]. "Innovation is closely linked to research and development. Sweden is one of Europe's top three spenders in this area, investing 3.6 per cent of GDP in R&D in 2009. Compare this with the EU-wide target of 3 per cent GDP investment

[52] https://techcrunch.com/2016/01/26/sweden-is-a-tech-superstar-from-the-north/

by 2020, and it's clear that Sweden is ahead of the game. A uniquely high proportion of research funding in Sweden comes from private foundations and other non-profit bodies," (Donnie SC Lygonis, Senior Advisor at Nordic Innovation House).

In order to promote innovation and regeneration, the Government is now working on initiatives to strengthen the innovative capacity of the business sector. This includes stimulating needs-driven research and increased innovative capacity, and providing support for commercialisation where private market mechanisms have a limited effect.

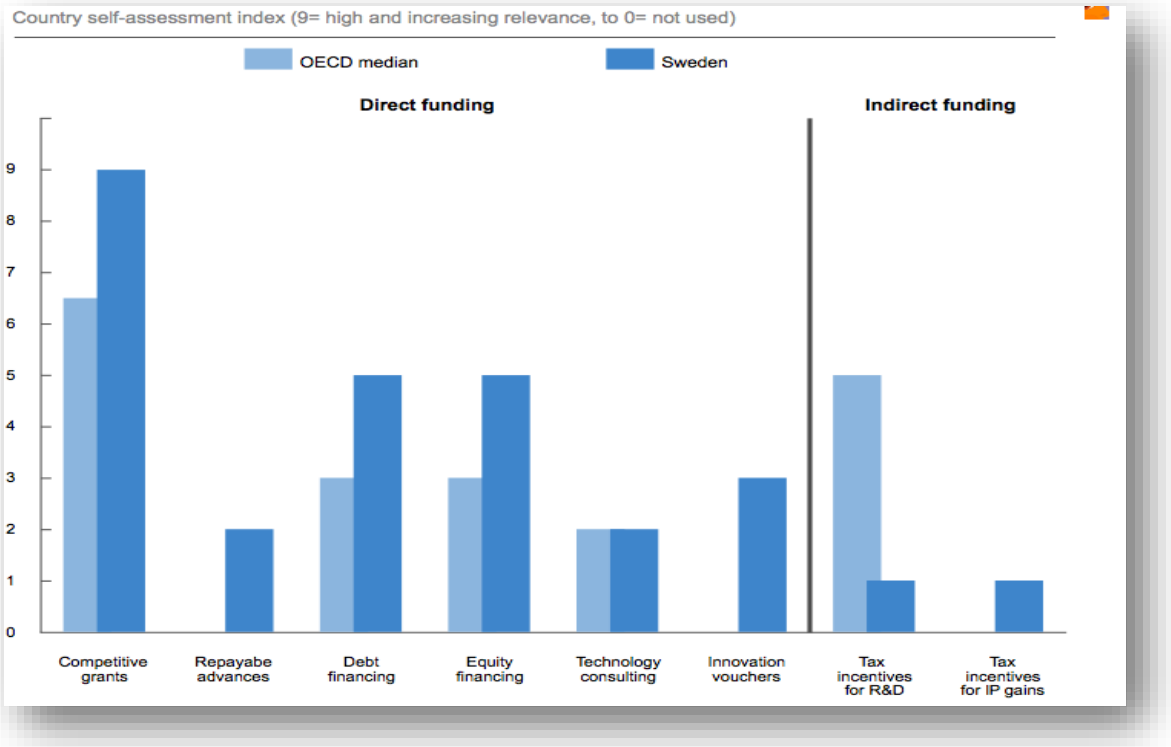
It's important to underline that Sweden's first innovation policy was presented in 2004 in the White Paper Innovative Sweden, which outlines four prioritised areas:

- Knowledge base for innovation:
  - Ensuring that Swedish education and research are of world class
  - Concentrating efforts in Swedish profile areas
  - Seizing the opportunities presented by globalisation
- Innovative trade and industry:
  - Strengthening the innovative capacity of existing SMEs
  - Increasing the commercialisation of research results and ideas
- Innovative public investment:
  - Using the public sector as an engine for sustainable growth
  - Promoting renewal and efficiency in the public sector
  - Developing infrastructure that promotes renewal and sustainable growth
- Innovative people:
  - Stimulating entrepreneurship and enterprise
  - Making the most of people's skills.

In formulating policy, the government is supported by a Research Policy Council, an Innovation Policy Council and the Institute for Growth Policy Studies (ITPS), but nobody has any formal authority meaning that they are reduced to advisory functions. The Ministry of Education, Research and Culture is responsible for research policy and thus for research policy bills. However, in the Swedish governance model, a decision by a ministry needs to be approved by all other ministers to become a government decision. While the ministry defines policy, implementation is carried out by relatively independent implementing authorities, which annually receive their instructions from government. This means that the government's

influence is limited to general principles and directions on how policy is to be implemented, which translates into a lower level of influence over how policy is implemented than in most other countries[53].

Figure 7: Most relevant instruments of public funding of business R&D, 2014



Source: Innovation Policy Platform of Sweden

The Swedish policy mix has developed incrementally and is clearly an "ex-post" reality, but slowly things are changing. Sweden now has its first innovation policy, which is the combined result of visionary politicians, an intense policy debate on the Swedish paradox, industry lobbying and the Lisbon strategy. The innovation policy essentially paints the broad picture for future policy development; the 2005 research policy bill, as well as other lesser government initiatives, constitute partial implementations of the innovation policy. However, the change in government from social democratic to conservative resulting from 2006,

[53] Tomas Åström Faugert & Co Utvärdering AB, Monitoring and analysis of policies and public financing instruments conducive to higher levels of R&D investments The "POLICY MIX" Project

elections makes it difficult to predict how innovation and R&D policies will evolve. The new government's initial policy declaration nevertheless speaks of increased spending on R&D.
A fiscal instruments to reduce labour taxes and R&D tax incentives together with a more flexible labour legislation in the long term would have far greater effect on R&D investments. Thus, a combination of grant-based instruments and such "new" instruments would appear appropriate. Innovation has long been at the core of Swedish economic and social development. It has reinforced Swedish enterprises' strong international competitiveness in manufacturing and services and it has also generated the revenues to be distributed throughout society and reinvested in innovation activities. This virtuous circle has helped transform Sweden into one of the world's most innovative economies and societies. Innovation has been facilitated through sharing productivity gains and an active labour-market policy mitigating the frictions associated with "creative destruction". The 2012 Review confirmed Sweden's position as an important international centre of scientific excellence and technological leadership. Sweden performs well in the field of science, in terms of both the volume and quality of its scientific publications (as assessed by the share of citations). Sweden can also boast a higher number of international patents per capita than most OECD countries – far above the EU average. The general picture that emerges is that Sweden has maintained a high level of performance, but has done less well in recent years than a number of comparator countries. By international standards, innovation is comparatively well accepted in Swedish society[54].

2.4 Norway

2.4.1 Basic Information

The geography of Norway facilitated an industrialization process that relied heavily on natural endowments. In the period between 1905 and 1920, the wider foundations of the modern economy were laid in the form of private and government initiatives for co-locating heavy industry and power plants at large waterfalls. Innovations developed by the first companies of this kind were highly knowledge-intensive and considered as technological breakthroughs. This industrial build-up was heavily supported by a large amount of foreign direct investment

[54]http://www.vinnova.se/Documents/OECD_Review_of_Innovation_Policy_Sweden_2016_prel_ver.pdf

(FDI) from Europe. Today, the most important sectors based on natural resources extraction are, in addition to fisheries and aquaculture, the sectors centred on oil and gas extraction, which were developed from the early 1970s onwards. Smaller proprietor- managed firms in agriculture, trade and manufacturing gave vital input to the Norwegian political economy during the 1800s, and many later became central within sectors such as furniture, engineering and machinery. The SMEs were (and still are) often family-owned and dependent on local financing. Their business activities were then gradually supplemented with a few larger enterprises exploiting natural resources [55] . Norway's economic performance has been consistently very good for a long time, and average real incomes are now among the highest in the world. The growing size and profitability of the offshore hydrocarbons sector has been a major factor, but even if it is excluded from the calculations, per capita GDP in mainland Norway is comparable to that of neighbouring Finland and higher than that of the major EU countries. Norway is also one of the best-performing countries in terms of growth and level of labour productivity, especially in private services. More than many other countries, Norway has cultivated strong social support for action to contribute to solving problems of global relevance, such as sustainable development and related issues. Large-scale programmes to address such topics could potentially have widespread impact on Norwegian industries and science and technology fields[56]. But Norway's innovation performance is not very impressive, indeed Norwegian businesses invest much less in R&D than other rich countries on Europe. It is also low on most innovation indicators. "Co-evolution" between industry, the R&D infrastructure and politics shaped the development of the Norwegian NSI. Norway, rich on resources (land, forest, fish, metals, waterfalls, oil and gas), industries exploiting these advantages (natural resource based industries) developed. A national R&D infrastructure (and policy set up) adapted to the needs of these industries gradually evolved. The process started in mining, agriculture/forestry and the maritime sector and continued – from the first half of the 1900s onwards – with industries based on the exploitation of hydro electrical energy. The result is a little R&D, but a relatively large sector of R&D institutes serving these industries (up to 30-40% of the firms in these industries report cooperating closely with such institutes). The oil and gas industry shared these characteristics, and the national R&D infrastructure

[55] Anders Lundström, Entrepreneurship policy in the Nordic countries – perspectives of the development since 2003

[56] OECD Reviews of Innovation Policy: Norway

gradually (from the 1970s onwards) adapted to its growing needs. Today the oil and gas industry dominates the economy and engages – directly and indirectly - a large share of the available talent and competence[57]. The key strategic task for the Norwegian government is to maintain a high and sustainable growth even after the reduction of oil and gas reserves. Any predictable restructuring of the Norwegian economy compatible with this goal will involve a change towards knowledge-based activities for which innovation is the key determinant of competitiveness.

2.4.2. Actors in the innovative context

Norwegian R&D policy formulation is based on the so-called "*sector principle*", meaning that each ministry is responsible for promoting and funding research activities within their own areas. The Ministry of Education and Research is responsible for the overall R&D policies, for funding large parts of basic science in the universities and colleges, and for co-ordinating sectorial R&D policies. Another central institution in the Norwegian innovation policy system is the Industrial Development Corporation of Norway (SIVA), which is a state owned enterprise which is controlled by the Minister of Local Government and Regional Development. It was established to further the creation of business opportunities and increased employment, and focuses upon developing strong local environments by providing investment capital, competence and networks for small and medium-sized companies.

The National Institute of Technology (TI) and the Advisory Institute in Northern Norway (VINN) are both private foundations which receive public support. TI offers small and medium-sized enterprises relevant expertise to improve company know-how, productivity and profitability. VINN's purpose is to improve the competitive strength of companies through increased productivity, improved profitability, stronger market orientation and profitable environmental and quality management measures. The institutional set up of Norwegian innovation policies has recently suffered several changes. A restructuring of the Research Council of Norway, which stands overall responsibility for national research strategy and manages nearly one third of public sector research funding, came into effect in September 2003. One of the principal tasks of the Research Council of Norway is to promote cooperation and coordination among Norwegian research institutions. The Council identifies important

[57] Jan Fagerberg, The evolution of Norway's National Innovation System

fields of research, allocates funds and evaluates R&D. It is also called upon to offer strategic advice to the Government on science and technology issues.[58]

2.4.3 SWOT Analysis of Norway's innovation system

The exploitation of natural resources has shaped the development of the Norwegian economy. A long tradition in fishing has recently been complemented by a strong export-oriented aquaculture industry. The discovery and extraction of oil and gas, including the expansion of related industrial activities in engineering and services, have strongly affected the economy and have had a deep impact on the country's innovation and R&D system. Norway shares many cultural features with the other Nordic countries, including an egalitarian society, a high degree of individualism, and relatively high tolerance for uncertainty.

Strengths

- A highly educated labour force
- Strong consensus on the desirability of technological change and productivity increase generated by co-operation between the social partners.
- Political commitment and institutional capabilities to foster science, technology and innovation. Fostering innovation has been a priority of successive governments.

Weaknesses

- A comparatively low level of R&D/innovation in some parts of the Norwegian business sector, especially in manufacturing.
- In a rapidly globalising world, Norwegian industry does not profit enough from R&D conducted abroad and needs to adopt a more international perspective.
- As in most other OECD countries, students and potential students are relatively uninterested in mathematics, science and technology courses

[58] Per M. Koch, Innovation Policy in the Nordic Countries 2004, Trend Chart Nordic

Threats

- Policy contradictions may result in ineffectiveness. (Policy mechanisms to satisfy the need for both critical mass and regional empowerment are not in place)
- A shortage of people with appropriate research skills. While there is no fundamental shortage for the moment, there has been a fall in the numbers of students opting for scientific and technical disciplines.

Opportunities

- Its current specialisation provides a strong base on which to develop and strengthen related economic activities. A balance needs to be struck between policies to establish wholly new activities and those that build on existing strengths.
- Norway's unique combination of capabilities and resources can be matched with global opportunities to create and expand market niches, especially in areas in which global needs are pressing (e.g. clean energy, food, water, health, security, etc.)59 .

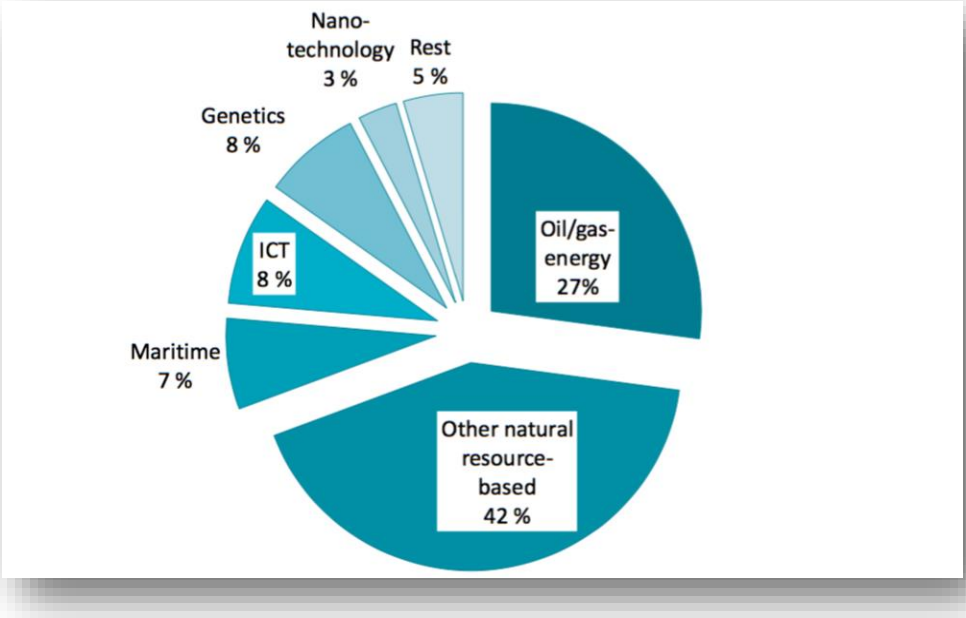
2.4.4 Actual Situation and objective for innovation

According to the Community Innovation Survey (CIS) there was a slight negative trend regarding innovation intensity in Norway during 1994–96 and 1997–2001. The overall assessment is that Norwegian firms on average are not particularly innovative. Only about 30% of Norwegian firms can be classified as innovative, and the share of innovating firms remained unaltered in 1997–2001. It's worth mentioning that the share of Norwegian firms that have introduced products that are new is quite low, which indicates that many of the innovations are diffusion-based (adoptions of innovations made by others). One feature of innovation intensity in Norway is the difference between SMEs and large firms (considerably more innovative). There may be several reasons for this difference: large enterprises (LEs) often have more financial and knowledge resources, and also usually have a broader range of products and more processes than smaller firms. However, while the share of innovating Norwegian LEs is on the same level as in the other CIS countries, the Norwegian SMEs

[59] OECD Reviews of Innovation Policy: Norway

distinguish themselves from other European SMEs by having a low share of innovators[60].

Figure 9: Innovation support in Norway



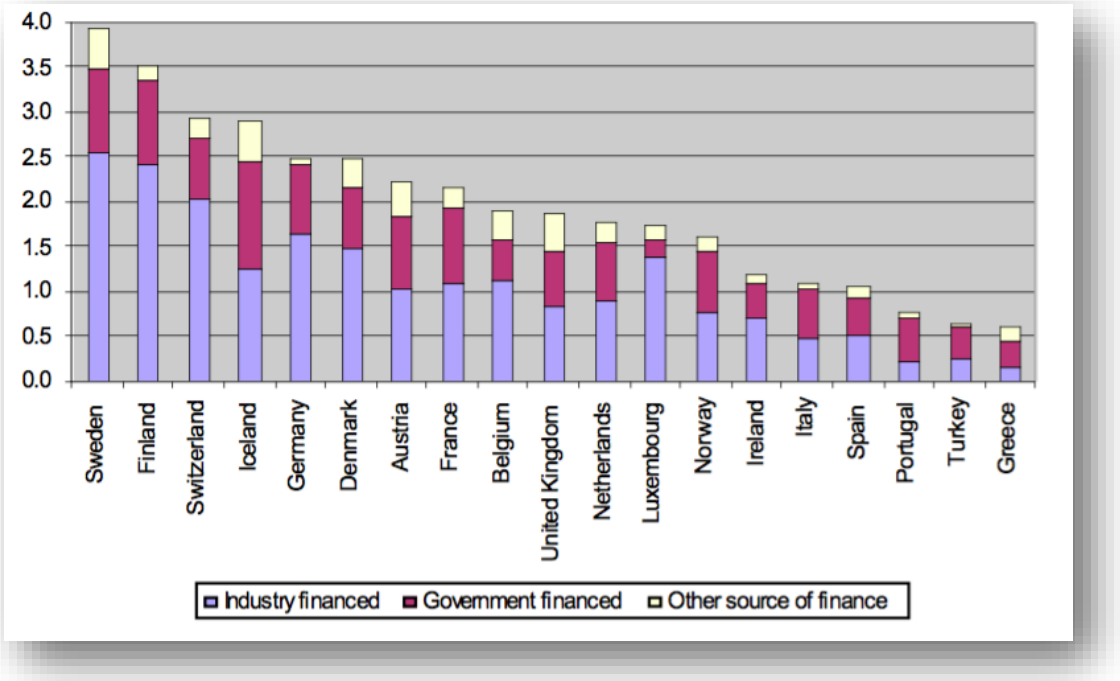
Source: Fagerberg J. "Innovasjonspolitiske Virkemidler"

Innovation is often associated with high-technology industries, such as information and communication technologies, scientific research in large-scale facilities in firms or universities, and professionals working in urban environments. Norway, however, has no major international firms in high-tech industries, and no university that ranks among the top 50 worldwide. One manifestation of the strong performance of Norway's economy during the past 30 years is its high rate of labour productivity growth, which has averaged more than 2.5% per year since 1975 (OECD, 2007). Norway's strong economic performance, however, is associated with much lower levels of R&D investment than in most other high-income European economies. Norway's economy is characterized by a relatively large share of government- financed R&D, which consists mainly of R&D carried out in universities and institutes within the public sector[61].

[60] Anders Lundström, Entrepreneurship policy in the Nordic – perspectives of the development since 2003, Norden

[61] Jan Fagerberg, David C. Mowery, innovation-systems, path-dependency and policy: The co-evolution of science, technology and innovation policy and industrial structure in a small, resource-based economy

Figure 8: R&D as a % of GDP: Norway and a reference group of European economies, 2004



Source: OECD

While R&D spending is a widely used indicator of innovation, it is only one of several important contributing factors in successful innovation. Likewise, the importance of R&D investment relative to other factors varies substantially among economic sectors.

The main conclusions to be drawn are that framework conditions and policies in Norway are currently at least adequate to support a high level of innovation activity, indeed a level that is higher than is actually measured by the usual indicators, especially but not only, of R&D spending and IPR activity.[62]. The central goal in current Norwegian innovation policies has been to strengthen the quality of both education and research in the Norwegian universities and university colleges. There is great interest in innovation systems theory and the concept of clusters in several ministries (Ministry of Industry and Trade and the Ministry of Local Government and Regional Development). This has led to the establishment of several instruments that are to encourage networking and the distribution of knowledge, competence and personnel in various parts of the innovation system[63].

[62] OECD Reviews of Innovation Policy: Norway

[63] Jan Fagerberg, David C. Mowery and Bart Verspagen, innovation-systems, path-dependency and policy: The co-evolution of science, technology and innovation policy and industrial structure in a small, resource-based eco

2.5 Finland

2.5.1 Basic Information

The innovation-driven economy developed as a result of increasing science and technology (S&T) content in production. Gradually, enhancing this development also became a political target. The birth of the Finnish S&T policy goes back to the 1960s and 1970s. This policy framework served as an important basis for the development of an explicit Finnish national system of innovation (NSI), which reached more or less its present form in the 1990s. Finland experienced a severe depression in the early 1990s, and the recovery from it was to a large extent due to fast growth in the ICT sector. Lately, innovative activity in Finland has been dominated by the electronics industry as reflected in the success of this sector, and particularly of Nokia. Application of ICT in other sectors is less widespread in Finland than, for example, in the USA. The two other pillars of the manufacturing industry (besides the electronics industry) are the manufacturing of paper and the manufacturing of machinery and equipment. The former is good in process innovations; the latter, in product innovations. There are also innovative manufacturing sectors and firms in the country other than just the electronics industry and Nokia. The Finnish approach to S&T policy, both the policy doctrines and the institutional and organizational models, was largely adopted and imitated from several OECD countries, especially from Sweden, the UK and the USA. A reform of research councils, and the formation of the Academy of Finland in 1969–71 marked an important step in science policy and in research funding. The Academy founded new research posts and started funding project research. It became a central organization in research funding but also an important actor in research policy[64]. The role of new technology in economic growth and employment creations are really important in Finland and accent on new technology has become a new core for the S&T policy. Tekes (the National Technology Agency), a new organization which was founded to promote technological R&D and diffusion of technology in the country. National technology programs were developed to give Tekes a framework for controlling and promoting R&D. it was the first program concentrated on IT. In the administrative field of this ministry, it has a central position in the planning and

[64] Charles Edquist, Leif Hommen, Small Country Innovation Systems, Globalization, Change and Policy in Asia and Europe

financing of technological R&D. Indeed it is the principal source of public funding for applied technological research and industrial R&D. During the economic depression in the beginning of the 1990s Finland started preparing a new national industrial strategy. The industrial policy was mainly based on ideas from Porter's diamond and cluster models. The new guidelines for industrial policy indirectly promoted structural changes by targeting the areas where markets were working insufficiently, by utilizing external effects of investments in R&D, by developing production factors (mainly know-how and research) and by advancing the working of markets. The deep economic crisis paved the way for a re-allocation of large sums in the favor of science and technology measures. Two concepts, "a national innovation system" and "knowledge and know-how", were the building blocks of the new science and technology policy paradigm, and the new terms like "cluster policies" and "innovation systems" became popular. The new technology policy guidelines for the years 2003-2006 of the Ministry of Trade and Industry include some, though cautious, references to future challenges of Finland. The guidelines emphasize the need to be able to identifying changes and new phenomena as well as new possibilities and opportunities created by changes.
Today, Finland is ranked as one of the leading countries in innovation.

2.5.2 Actors in the innovative context

The Science and Technology Policy Council of Finland coordinates innovation policy activities at the national level. The main tasks of the council include directing science and technology policy, dealing with the overall development of scientific research and education, and issuing statements on the allocation of public science and technology funds to the various ministries and fields. Moreover there are other two important ministries in the Finnish national innovation system: the Ministry of Education and the Ministry of Trade and Industry. Each administers approximately 38 percent of the public research funding. The Ministry of Education covers 20 universities, a network of polytechnics (29) and the Academy of Finland, which includes four national research councils. The Academy of Finland is the central financing and planning body in the field of basic science and university research.
The Ministry of Trade and Industry is responsible for technology policy and providing support for industrial R&D. Another relevant figure is the Technical Research Centre of Finland (VTT), an impartial expert organization carrying out technical and techno-economic R&D work. VTT is the largest governmental research institute in the Nordic countries.
Sitra (Finnish National Fund for Research and Development) is a relatively autonomous

organization that is subordinate to the Finnish Parliament. Its activities have expanded from the original task of financing technical R&D to cover a range of research, educational and venture capital activities that benefit the economy and the society at large. The Foundation for Finnish Inventions supports and promotes invention work and the development and exploitation of inventions in Finland[65].

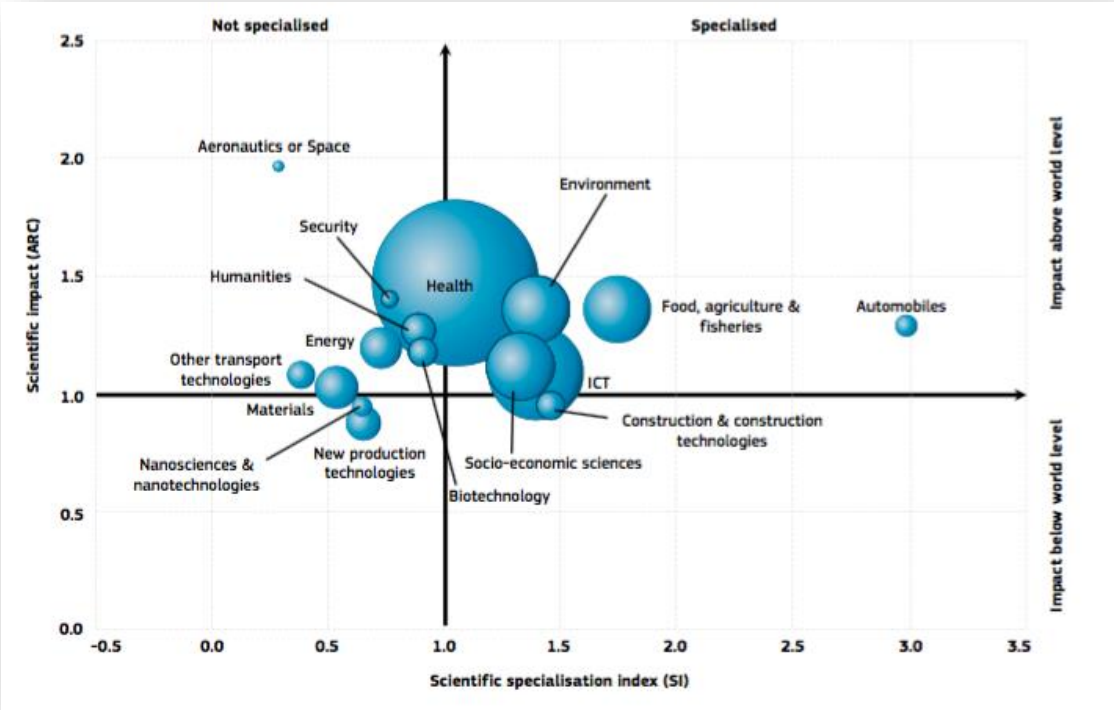
2.5.3 Technology advantage

According to the summary innovation index of the European Innovation Scoreboard 2004, Finland was second in innovativeness among EU countries (after Sweden). In terms of innovation intensity in the Community Innovation Survey (CIS), Finland ranked second after Sweden within a group of six countries that included Denmark, Ireland, the Netherlands and Norway Finland has one of the world's highest R&D intensities. In terms of scientific and technological capabilities, the country acts pretty well, showing a strong positive evolution. Its strengths lie especially in the share of new products, the share of firms introducing new-to-the-firm products, the share of firms introducing new-to-the-market products and the share of innovative firms. In the case of non-technological innovations, this sector concentrates on organizational innovations. The communication equipment industry produces mainly mobile phones and mobile phone networks. The largest firm in the sector is Nokia. The Finnish economy is knowledge-intensive and has achieved an impressive and continuous change towards a stronger high- and medium- high-tech specialization. It has several hot-spot clusters in key technologies on both a European and world scale, in particular in ICT, the environment, materials, energy, security, and in food and agriculture. The decline of this sector (telecommunication) is further reflected in a decrease in business R&D expenses that were previously dominated by Nokia. Consequently, as part of the Europe 2020 strategy, the Council recommended in 2014 that Finland boosted its capacity to deliver innovative products, services and high-growth companies in a rapidly changing environment. To address these challenges, the Finnish government has intensified the reform of the national R&I system. In addition to general efforts to enhance the efficiency and improve the internationalization of the system, current and planned policy reforms are targeted, in

[65] Per M. Koch, Innovation Policy in the Nordic Countries 2004, Trend Chart Nordic

particular, at increasing the number of high-growth innovative firms as the major source of future employment and growth[66]. According to the European Innovation Scoreboard 2004 (European Commission, 2004), the Finnish electrical and optical equipment sector ranks at the top in innovativeness among the EU countries. In Finland, this sector consists mainly of the production of telecommunication equipment. Innovations are mostly implemented by firms registered in Finland and the largest of them are international but some of these firms also have innovation activity abroad[67].

Figure 9: Finland – Positional analysis of publications in Scopus, 2000-2010



Source: DG Research and Innovation

The graph illustrates the positional analysis of Finnish publications showing the country's situation in terms of scientific specialization and scientific impact over the period 2000-2010. The scientific production of the country is reflected by the size of bubbles, which corresponds to the share of scientific publications from a science field in the country's total publications.
The ongoing restructuring of the ICT sector is both a challenge and an opportunity for Finnish

[66] Research and innovation performance in Finland; European Commission
[67] Charles Edquist, Leif Hommen, Small Country Innovation Systems, Globalization, Change and Policy in Asia and Europe

SMEs, as much of future innovation and growth depend on them. The graph does not take this fully into account. It is expected to affect, in particular, the number of business sector researchers and business R&D intensity. Another index that help us to understand the technology advantage of Finland is the revealed technology advantage (RTA), which provides an indication of the relative specialization of a given country in selected technological domains and is based on patent applications filed under the Patent Cooperation Treaty. It is defined as a country's share of patents in a particular technology field divided by the country's share in all patent fields. The index is equal to zero when the country holds no patent in a given sector; is equal to 1 when the country's share in the sector equals its share in all fields (no specialization); and above 1 when a positive specialization is observed. Only economies with more than 500 patents over the period reviewed are included. Data are drawn from the OECD Patent Database[68].

[68] http://www.oecd-ilibrary.org/science-and-technology/data/oecd-science-technology-and-industry-outlook/revealed-technology-advantage-in-selected-fields_data-00673-en

Figure 10: Revealed technology advantage of Finland in selected fields

Indicator	Bio- and nano-technologies	Information and communication technologies	Environment-related technologies
	RTA in bio- and nano-technologies	RTA in ICT	RTA in environment-related technologies
Time	2007-09		
Country			
Finland	0.59	1.35	0.70
China	0.42	1.32	0.59
Korea	0.68	1.25	0.90
Japan	0.70	1.22	1.38
Canada	1.55	1.14	1.12
Israel	1.34	1.13	0.71
"BRIICs economies -Brazil, Russia, India, Indonesia, China and South Africa"	0.57	1.12	0.67
Sweden	0.60	1.09	0.85
Ireland	1.38	1.05	0.79
United States	1.39	1.04	0.74
Netherlands	1.20	1.00	0.97
United Kingdom	1.04	0.90	0.84
France	1.01	0.82	1.08
Hungary	0.97	0.79	1.45
Australia	1.44	0.79	1.14
OECD sample median	1.03	0.77	0.95
European Union (27 countries)	0.91	0.76	1.12
Norway	0.65	0.74	1.48

Source: OECD Library

2.5.4 Actual Situation and objective for innovation

Finland is a very good performer in the European innovation indicator. It ranks fifth in the EU after Germany, Sweden, Ireland and Luxembourg. This is the result of a very good performance as regards all the components of the indicator, with the exception of the export of goods and services. Finland's strong industrial base, know-how and excellent availability of wood raw material provide a good platform for bio-economy and other clean-tech investments. The country's performance stagnated between 2010 and 2012.

Finland performs particularly well in patents (data refers to 2010), where it is the EU's top performer as a result of strong patenting in the ICT sector. It has a strong innovation performance and overtakes its reference in terms of highly skilled human resources (new graduates in science and engineering as well as business enterprise researchers), public and business investment in R&D and patent applications. The main weakness in the Finnish innovation system lies in its low level of internationalization, affecting both the public and

private sectors. It performs below the EU average on inward BERD, share of foreign doctoral students and funding from EU excellence-driven programs[69].

The relatively low performance in the share of medium-/high-tech goods in total goods exports is explained by the importance of wood and paper exports, not sufficiently compensated for by strong exports of medium-/high-tech products.

As a freight-transport transit country to and from Russia, Finland has a relatively important non- knowledge-intensive transport and merchant- related services (rail freight transport, pipeline) sector, leading to a below EU average share of knowledge-intensive services exports, despite relatively high computer services exports.

The Government's the key actions for maintaining the competitiveness of Finland are:

- Promotion of R&D
- Raising the educational level of the population
- Pursuing a cooperative approach to income policy
- Boosting the productivity of the public sector.

Policy measures to promote a more efficient commercial exploitation of research results remain a big deal for each Government. The government of Finland views entrepreneurial activity as the base of Finland's competitiveness and is committed to providing companies with the world's best operating environment. Hence, Finland has consistently developed its innovation policy and one of the strengths of the Finnish innovation environment is the active and successful dialogue involving companies, research institutes and the public sector. In order to have a new governance approach, the new Finnish Government has launched broad inter-sectorial policy programs aimed at horizontal coordination and implementation of public actions that promote employment, entrepreneurship, information society and civil participation. A faster implementation of new information technology is also identified as a national objective. The new Entrepreneurship program aims, for instance, to foster company start-ups, growth and internationalization. The most important aim is to boost competitiveness and productivity, promote social and regional equality through the effective utilization of information and communications technologies in all sectors of society[70]. In the recent years

[69] Research and innovation performance in Finland; European Commission

[70] http://www.oecd.org/finland/sti-outlook-2012-finland.pdf

there's a higher attention paid to the effects of internationalization on innovation: indeed a major future challenge will be to keep Finland sufficiently attractive for businesses and employees. Hence innovation policies cannot be limited to the national environment and traditional international cooperation. Finland will have to internationalize its innovation activities and national science and technology institutions. Moreover, innovation policies must now go beyond economics and include societal development. There are growing concerns about whether the system and innovation policy really match the needs of Finish industry and its internationalization. Innovation orientation, rather than technology orientation is regarded a critical condition for increasing growth and competitiveness. In the future, investments in the ICT sector are expected to focus particularly on automotive electronics and software, smart traffic, health and wellbeing technology, game industry, wireless technology, industrial internet, cyber security and data centers. The goal is to accelerate growth, create new businesses and renew traditional industries through innovation[71].

[71] Veronique Clement, Finland's economy and innovation sector, Ambassade de Finlande

CHAPTER 3

CHINA'S INNOVATION POLICY

3.1 New strategies of governance in urban China: Community concept

A growing fame of the idea of 'community' within public speech in the People's Republic of China (PRC) has grown and it has generated a rapid transformation of China in the last decades. Here, as elsewhere, 'community' has been suggested in part as a counterbalance to cultural, social and political fragmentation which is often seen as a negative consequence of globalization. One of the more interesting aspects of the emergence of community policy in China is the speed with which the concept of 'community' has been transformed from a relatively abstract idea into a specific institutional model. At the moment it is designated as the basic unit of urban social, political and administrative organization. The central government decided to enlarge the extent of community work in order to strengthen the entire popular organizational infrastructure. The original idea of 'community services' has given way to the broader concept of 'community building' (shequ jianshe). Under this new policy initiative, the community is expected to become a very specific form of popular organization; each community will have a distinct territory and be run by a team of officials employing a standardized selection of bureaucratic procedures. One of the principle reasons underlying the move to 'build communities' has been the failure of the Chinese government to meet the demand for social services brought about by the rapid socio-economic transformation of urban China since the mid-1980s. This means that 'community building' in urban China presents a hybrid combination of strategies for community governance; it combines some fairly direct modes of governmental intervention, with a well-developed system of voluntary service and a commitment to the efficacy of community as an agent for moral improvement. If 'community building' is even partly successful, then, it will reduce the future costs of government considerably. Moreover, it may partially alleviate the dangerous dislocations, ruptures and disparities that currently threaten to undermine the remaining vestiges of state

legitimacy in present-day China[72]. The Chinese economy has grown at a record-setting rate of about 10% annually, since the launching of the economic reforms in 1978. Many factors have played important roles in the growth process:

- Rural reforms, which made the household the unit of agricultural production
- Enterprise reforms, which introduced material incentives to enterprise management
- The opening up of the market to international trade and foreign investment
- Importation of technology
- Fiscal reform, which has contributed positively to the growth process of Chinese economy

We have to recognize a remarkable transformation: the speed of economic change in China has been extremely rapid since the start of economic reforms just over 25 years ago. China's economic reform process was gradual, therefore it is useful to distinguish between two periods in China since its foundation: the crucial shift was in 1978 when it was initiated an economy reform and the opening of the economy to the international world. The first period was characterised by a centrally planned economic regime and the second was with market-oriented reforms and economic transition under the guidance of central government. Since the implementation of the open policy and economic reforms, the performance of China grew extraordinarily and the structure of economy has been changed as well[73]. According to official statistics, economic growth has averaged 9.5% over the past two decades and seems likely to continue at that pace for some time. National income has been doubling every eight years. Such an increase in output represents one of the most sustained and rapid economic transformations seen in the world economy in the past 50 years. China could and maybe has become the largest exporter in the world by the beginning of the next decade. This extraordinary economic performance has been driven by changes in government economic policy that have progressively given greater lead to market forces. The transformation started in the agricultural sector more than two decades ago and was extended gradually to industry and large parts of the service sector. The government also rigorously enforced a number of

[72] David Bray, Building 'Community': new strategies of governance in urban China

[73] Ying Zhou , Regional Innovative Capacity in China: From the Perspective of Embedded Autonomy, USF Scholarship Repository

competition laws in order to unify the internal market, while sharpening the business environment by allowing foreign direct investment in the country, reducing tariffs, abolishing the state export trading monopoly and ending multiple exchange rates[74].

3.2 Actual situation and 13th Five year plan

The nation that goes all-in on innovation today will own the global economy tomorrow: this is definitely the case of China. With his declared goal to become a global leader in science and technology, the country's aim are to cultivate common entrepreneurship throughout the country and to shift from labour-intensive manufacturing to innovation-driven growth. China is dedicating resources and policy support to upgrade value chains, improve technological advancement and boost innovation in manufacturing and service industries. Indicators show that it has what it takes to rise to the lead of global innovation. This includes rising R&D spending (China's R&D expenditure reached $ 193 billion) in 2013, a 15% increase year-on-year, and is set to overtake the European Union and the United States to be the top R&D-invested country by the end of this decade), a large number of corporate patents, a new generation of entrepreneurial CEOs and high number of engineering and science graduates. The country's innovation drive has led to a significant rise in the number of private-sector firms in China that are increasingly moving from imitate to innovate, and also shifting from serving the domestic market to venturing into the global marketplace. There has also been the boom in China's maker and design culture, where start-ups are using crowd funding, open source designs and innovation incubators to jump-start the next disruptive product or technology. The Chinese government's push to reform its state-owned enterprises by encouraging mixed ownership, equity investment by non-state capital and managerial reform, is also an indication that innovation has not only extended to the private sector but is also impacting China's public sector[75]. China is closing the innovation gap: from drones to artificial intelligence, the Internet to genetic engineering, innovative Chinese companies are leading global innovation and reshaping the country's technology and business landscape. For much of China's economic boom over the past decades, labour and capital collected to attire and mobile phone manufacturers. But now China is trying to move beyond just being the

[74] Richard Herd and Sean Dougherty, China's economy: A remarkable transformation, Observer OECD

[75] https://www.weforum.org/agenda/2015/09/explainer-china-as-a-world-leader-in-technology/

world's factory. Policy makers want the country's future growth to drain strength from new technologies, new ideas and new business models. China's rise up the global innovation rankings has also been reflected in its businesses. It is now home to some of the world's most innovative companies, particularly in the fields of mobile technology, biotechnology and medical services[76]. Recently China's top government officials pointed out the importance of innovation for the economical development of the People's Republic. It has been stressed the significance of innovation on many occasions and have called for more technological cooperation between enterprises. Indeed the State Council released a national scientific and technological innovation plan in a proposal to build China into an innovative country and a scientific and technological power. This is based on the idea that innovation is the major development driving force, the plan is a bid designed for technological innovation development during the period of the 13th Five-Year Plan (2016-2020). The plan aims to increase China's technology and innovation capabilities, and boost the country's comprehensive innovation capabilities into the world's top 15. The plan urged to play the key leading role of scientific and technological innovation in uplifting the industries to the medium- and high-end, developing new growth drivers, expanding new development space, improving development quality and efficiency[77]. In order to realize this China should

- Strengthen original innovation capabilities,
- Cultivate important strategic innovation forces,
- Should support Beijing and Shanghai to build scientific and technological innovation centres with international clout,
- Set up a batch of innovative provinces and cities and regional innovation centres,
- Promote the innovative development of national innovation demonstration zones and hi-tech development zones

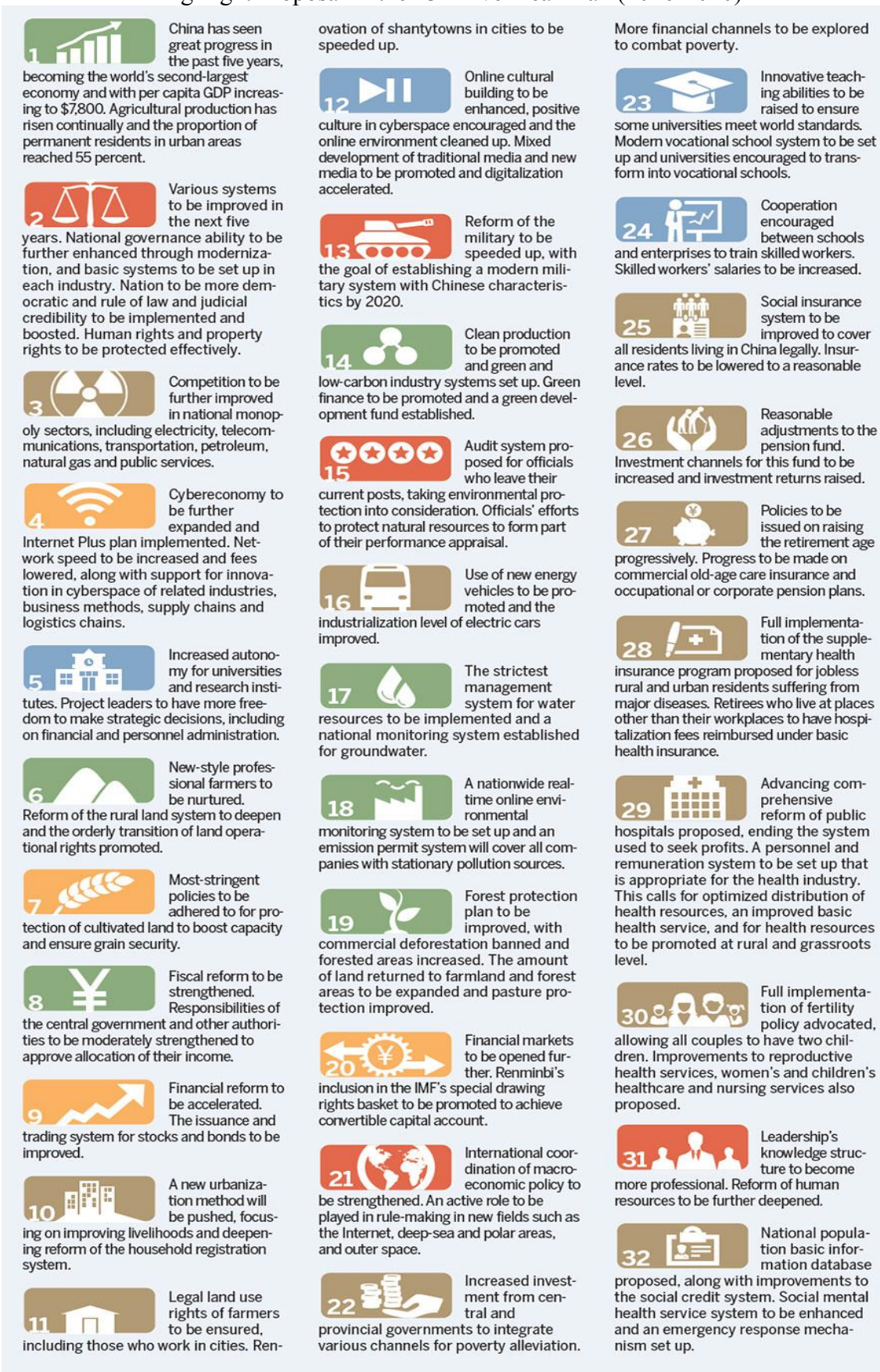
Thanks to this plan, China's policymakers expect technological improvement to drive emerging industries and repair traditional sectors. Researchers will also be motivated with more flexible fund management, higher rewards and strengthened protection of intellectual property. Scientific and technological advances should contribute 60% of economic growth

[76] Xinhua, The rise of China's innovation, Shanghai Daily

[77] http://english.gov.cn/policies/latest_releases/2016/08/08/content_281475412096102.htm

by 2020, up from the current 55.1%, and China's global ranking in innovation capability will also improve. The expectation is that the government will encourage tech-firms to play a leading role in technological innovation by improving business incubators, establishing a unified technology transaction market, and guiding more resources to innovation.

Highlight Proposal in the 13th Five-Year Plan (2016-2020)



Source: Xinhuanet

3.3 Chinese National Innovation System (NIS)

The OECD Reviews of Innovation Policy (which China joined in 2001) aim to assist the governments of examined countries in their efforts to promote more innovation-led economic and social development. The review of China is the most extensive, in terms of the breadth and the depth of the analysis, of the reviews carried out so far, in order to do justice to the vast scale and the complexity of China, as well as to the exceptionally fast pace of the transformation and development of the Chinese national innovation system (NIS). The NIS concept has been applied to map characteristics and differences in the structure of developing countries and encounters special application in the analysis of Asian economies. In it, knowledge is created and transferred and then invention and innovation occurs is central to the economic growth of countries and regions. The process of innovation development is similar to that of economic development; on the other hand, the development of innovation capacity was facilitated by the central government. But with the increase of the country's innovativeness and transformation in an innovative nation by 2020 and, furthermore, a world leader in science and technology by 2050, leads China's government to be highly worried. The overall innovation capacity of the NIS is condensed into the innovative performance of the key organizations and subsequently measured by the volume and value of patent applications. Innovative performance is used synonymously with all activities that contribute to measurable outputs of technological innovations within a NIS. If pioneers are important in increasing the rate of innovation by radical innovations, the remaining strategies are more significant for the diffusion and further utilization of knowledge. This is also an integral part of a NIS and, thus, linked to the "absorptive capacity" of key organizations within the NIS[78]. The Chinese NIS has experienced tremendous changes since the start of the reform of the science and technology (S&T) system in 1985. The business sector has become the dominant research and development (R&D) actor and now performs over two-thirds of total R&D. Less than 1% of all Chinese companies have applied for a patent and only around 2 000 domestic enterprises, 0.03% of the total, own their own IPR despite the emergence of successful Chinese firms in the high-technology sector and on the international market. One of the most

[78] Philipp Boeing, Philipp Sandner, The Innovative Performance of China's National Innovation System, Frankfurt School – Working Paper Series

remarkable changes in the Chinese NIS landscape is the rapid increase in the number of R&D centres established by foreign companies[79]. Researchers with backgrounds in political science, political economy, and economics have begun to analyse the innovation systems in China and former centrally planned economies. None of the studies, however, has explored the possibility that these nations, with very different starting conditions (i.e. central planning and functionally specialized organizations) and professed principles, could (or perhaps should) develop viable alternative system structures to accomplish technological innovation. They do an excellent job of identifying the key stakeholders, policies, and institutions of China's national innovation system. They also identify weaknesses in organizations and policies. However, they do not provide a system-level description of the system's structure, dynamics or performance. National borders will continue to represent important policy, legal, regulatory and often cultural boundaries, and policymakers' are primarily concerned with and have influence over local actors, institutions and outcomes[80]

3.3.1 The Development of China's NIS

The first National Science and Technology Development Plan (STDP) helped in the formation of the NIS during the period 1956-1967. Indeed China imported 156 heavy industry facilities from the Soviet Union and established 400 research institutes, which mainly focused on reverse engineering. Scientific successes were based upon Soviet assistance which made a bureaucratically and hierarchical R&D structure of China's NIS. The ultimate goal of the Chinese government during this period was the creation of national self-reliance. Due to the lack of adequate technology developed domestically, State-owned enterprises continuously upgraded production capabilities through technology imports. Moreover, organizations within China's command economy had not been exposed to fundamental drivers of a market-driven economy's modern NIS: profit incentives, competition, and an increasingly selective market demanding for a diverse set of products and processes. However, during the transformation period starting after 1978, these drivers did not directly trigger R&D intensity but allowed for business models relying on cheap labour and arbitrage strategies in extremely unsaturated

[79] CHINA, OECD Reviews of Innovation Policy

[80] Xielin Liu, Steven White, Comparing innovation systems: a framework and application to China's transitional context, Elsevier

markets. The transformation process had been accompanied by the promulgation of several laws, most essential the Trademark Law in 1982, the Patent Law in 1984, the Technology Contract Law in 1987 and the Copyright Law in 1990[81]. Thanks to these new introductions, inventions have been protected by so-called "innovation patents", China's patent type for protecting technological inventions. Finally, after all, patenting has not to be underestimated. Due to young history and the fundamentally new rational, patenting was probably only internalized gradually by domestic key organizations in China's NIS. Even if we have to say that the formerly poor enforcement of IPR improved during recent years, leading to more reliable protection.

3.4 Does have China a competitive advantage?

In the past decade, the export performance of the Chinese economy has been phenomenal. In recent years, the record of Chinese exports has been spectacular, though cyclical. Chinese exports have expanded in some years by 20 to 30%. Other East Asian countries have also shown rapid export growth but, despite substantial devaluations, in recent years many have lagged behind. Thirty years of on going economic reforms in China has led to an uninterrupted annual economic growth rate of more than 9% on average. In 2010 China surpassed Japan in terms of GDP and became the second largest economy in the world. Policy reform and innovation have been important drivers of China's remarkable achievement. Since 1978 China has implemented a series of large-scale science and technology (S&T) reforms that have accelerated progress in higher education and research and development (R&D). As a result of the global financial crisis, China was pressed to make structural economic reforms that focused on building up domestic innovation infrastructure and the competitiveness of domestic research institutions. These policies have become key factors in influencing the country's continuing economic development. Indeed in 2014 the Global Innovation Index (GII) ranked China at 29th place worldwide. In 2012 the total R&D investment in China increased to 2% of GDP[82]. The share of local government fiscal expenditure on S&T relative

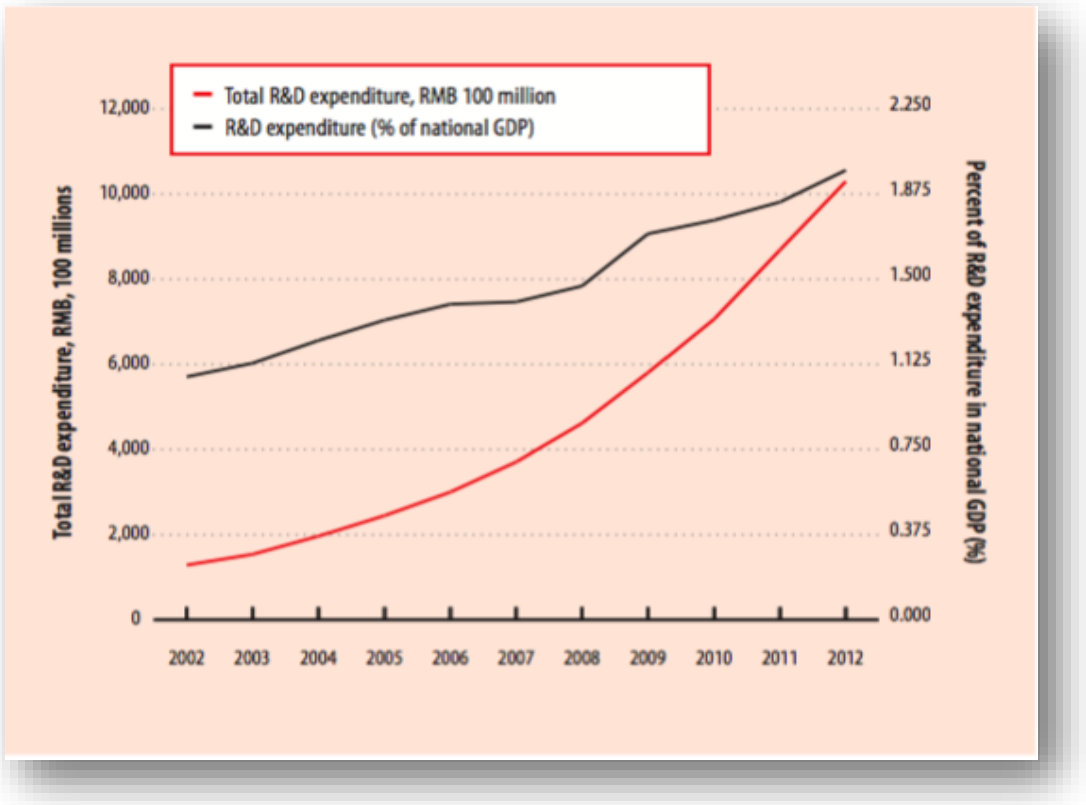
[81] Philipp Boeing, Philipp Sandner, The Innovative Performance of China's National Innovation System, Frankfurt School – Working Paper Series

[82] Soumitra Dutta, Bruno Lanvin, and Sacha Wunsch-Vincent, The Global Innovation Index 2015 Effective Innovation Policies for Development

to the central government fiscal expenditure on S&T jumped from approximately 40% of total government fiscal expenditure on S&T before 2007 to approximately 50% since 2007. China's S&T development in this decade express itself in four areas:

1. R&D investment; the results of innovation (patents),
2. Products, and research publications;
3. Science education;
4. Cultivation of R&D talent

Figure 12: Total R&D Investments 2002–12



Source: National Bureau of Statistics of China 2013.

Constantly rising volumes of patent applications mirror both, the improved protection of IPR and the increasing capacity for inventiveness. Supplemented by the continuous growth of the Chinese economy, improving conditions are reflected and reinforced by more R&D-intense

FDI. The creation of low-value innovations albeit increasingly in huge quantities. Low value inventions are worthless per se, but it depends how they are applied to the local market. A new trend is led by relatively young firms in high-tech industries.

Moreover, between 2002 and 2012 technology product output increased rapidly, especially after 2006. This increase demonstrates that the Chinese government's innovation policies were successful in attracting organizations to invest in R&D and helping enterprises to be more successful in terms of innovation. Furthermore, it's important to underline in order to explain this advantage that the quantity of undergraduates and Master's graduates has clearly increased during this last period. Both the quality and quantity of researchers has greatly enlarged, and the rate at which researchers in basic sciences has increased has been comparatively higher than the rate of increase of researchers in other areas. China has pointed out a national target of becoming a leading innovative country by 2020, as already said before. Achieving this target depends on continuing policy reform to further improve a balanced relationship between the government and market forces; to establish a more comprehensive innovation ecosystem; to nurture a legal and regulatory system that encourages investment in innovation and entrepreneurship by all sectors; and to foster open and fair competition among private, state- owned, and foreign enterprises[83]. To achieve this, some reforms made by the country have been implemented:

- *National Act for Promoting Technology Transfer*, which has given universities and public institution's the independent right to license the patents generated from central government R&D funding
- *Action Plan on the Implementation of National Intellectual Property Strategy,* which has the aim to simplify market processes for transactions concerning to intellectual properties,
- *The National Equity Exchange and Quotations*, a special stock market which allow to technology start-up companies (not yet profitable), to have more paths to raise development capital,
- A Guideline for the Development of Public Incubation Space to Promote Grassroots

[83] Soumitra Dutta, Bruno Lanvin, and Sacha Wunsch-Vincent, The Global Innovation Index 2015 Effective Innovation Policies for Development

Entrepreneurship, which encourages the participation of multilevel capital markets (crowdfunding).

Nevertheless, Zhongguancun, better known in the west as China's Silicon Valley is the area which has a dynamic economy that focuses on the knowledge and information industries. The average age of the several hundred thousands of employees in there is about 30. It is a product of the development of the market economy. The increasing use of computer and network technologies has accelerated the economic development of the region. It was the first state-level hi-tech industrial development zone to be founded in China. At present, the Zhongguancun Scientific and Technological Garden has more than 8,000 hi-tech enterprises, over 50% of which are IT enterprises. It not only houses large Chinese computer enterprises such as Founder and Legend, but also houses many foreign enterprises. The Zhongguancun Garden has become an important part of Beijing's economic development. This garden has seized the opportunities offered by the new technological revolution[84]. Indeed China's start-up scene is abuzz with new products, new ideas, and new investment, with some indigenous innovations. China's share of the world's high-technology manufacturing spiralled from 8% in 2003 to 24% in 2012. Two main examples are the following:

WeChat

It has come up with a very interesting way of business model innovation. It's a mobile messaging app that offers to users experiences that can rival any US competitor. It has launched several new services on its platform to monetize on its huge user base of 250 million daily active users and it includes mobile games, stickers, and the possibility for Chinese department stores to set up their own online stores on the platform and also an online payment system to pay for these services[85]. Among all its services, it is perhaps its promise of a cashless economy, that impresses spectators the most. Thanks to WeChat, Chinese consumers can navigate their day without once spending banknotes or pulling out plastic. It is the best example yet of how China is shaping the future of the mobile internet for consumers

[84] http://www.china.org.cn/english/travel/51023.htm

[85] Thijs van der Toom, WeChat's Business Model Innovation, Innovation China Beta

everywhere[86].

The Vending Machine 2.0, Alipay

It allows to pay for snacks with an App, indeed customers who are interested in a snack, but are short on cash, can use their smartphone to transfer the money. Just opening the app and making the payment will result in the vending machine serving for example a soda. Alipay covers almost 90% of the vending machine market in China. In the future all new vending machines will be equipped with this kind of payment solution[87]. According to an analyst research report, Alipay has the biggest market share in China with 400 million users and control of just under half of China's online payment market in October 2016.

Moreover, Beijing is now looking for ways of designing its own products rather than manufacturing someone else's. Put another way, "it wants to shift from making iPhones to inventing them"[88]. There are some paths that have been fundamental to promote innovation:

1. Chinese society is highly entrepreneurial, willing to make money and able to extract value very effectively. Innovations are seen in a totally market-oriented way and companies are ready to experiment and rapidly correct mistakes. Technical aspects constitute only a tool to be successful in the marketplace.
2. Copying a product, while improving many different elements of it and making it much better suited to the Chinese market, represents a legitimate way to operate. Innovating to reduce costs by copying and improving explains the success of many Chinese companies, such as Baidu (adaptation of Google), or Alibaba, initially inspired by eBay.
3. China's government is obsessed with providing a context favourable to innovation-led growth. Like Japan and Korea, innovation is perceived as a crucial ingredient of wealth-creation and economic development.
4. Chinese firms contribute a rapidly growing share of innovations that are private and entrepreneurial. They are very active in the ICT - information and communication technologies and electronic games. The weight of the state-owned enterprises (SOE) is

[86] http://www.economist.com/news/business/21703428-chinas-wechat-shows-way-social-medias-future-wechats-world

[87] Fabian Nijlant, The Vending Machine 2.0; Pay for your Snack with an App, Innovation China Beta

[88] David Wertim, It's Official: China is becoming a new innovation powerhouse, FP

decreasing, both as a factor of GDP and in the production of innovative offerings89.

3.5 How does China interpret Grand Challenges?

China has invested heavily in nearly all corners of its society, from infrastructure to education to politics. China's contributions to science and innovation are no exception; just as China has added high speed rail and world-class architecture to its efforts to build its society, it too has invested in its scientific capacity. China has also invested in innovation to better the lives of poorer people, including rural farmers and those suffering from neglected diseases. The Chinese Government increasingly refers to the need to address grand challenges (13th Five-Year Plan). It had also developed a legislative framework for addressing Grand challenges through a variety of laws: biotechnology, new energy, high-end electronic equipment manufacturing, energy conservation and environmental protection, clean energy vehicles, metal products, transport equipment and next generation IT[90]. We have to think about Grand Challenges China like an international team of government and private funders investing in innovation not for innovation's sake, but rather to solve the greatest challenges facing our civilization[91]. China's foreign direct investment traditionally has focused on resource acquisition, trade facilitation and technology acquisition. In the developed world, China has supported port and freight rail development, but it has also focused on acquiring technology through partnerships in the oil and natural gas industry and other areas. The scale of these large investments and collaborations is largest in electronics, software and related sectors. China has been making similar moves in other high-tech areas as well, including green technology, biotechnology, nanotechnology, engineering and health sciences. Although the country has often been criticized for stealing technology rather than developing it independently, in some areas the country is beginning to grow out of that stage of its development and contribute to the growth of technology[92]. As a matter of fact, China is fast transitioning from low-cost manufacturing to a higher value innovation-led economy. It is

[89] Georges Haour, Why China is on the Way to Being a Global Innovator, Industry week

[90] The international dimension of research and innovation cooperation addressing the grand challenges in the global context, European Commission

[91] McKinsey Quarterly, Gauging the strength of Chinese innovation, 2015

[92] https://www.stratfor.com/analysis/chinas-outward-push-high-tech-investment-and-innovation

clear that it is on its way to become a major, global power for innovation. This is mainly due to private firms, essential engines of the wealth-creation process. These, however, operate in a unique environment, in which the public sector is extremely powerful. Excepting major disasters, Chinese firms are expected to turn the country into one of the world's major sources for innovations, particularly in IT-enabled services. There is much to learn from the "Chinese way" of innovating. Some examples of great innovations are the following:

The Transit Elevated Bus (TEB)

It straddles the cars below, allowing them to pass through. Powered by electricity, the bus is able to carry up to 300 passengers in its 21m long and 25ft wide body. The vehicle is expected to reach speeds of up to 60km per hour, running on rails laid along ordinary roads. Passengers on board it are expected to experience a ride comparable to riding in the upper level of a double decker bus. They will board and alight at stations at the side of the road with platforms at the bus floor height similar to stations of an elevated railway, or via stairs descending through the roof of the bus from a station similar to a pedestrian overpass. The bus will have alarms to warn cars traveling too close to it, and signals to warn other vehicles when it is about to turn. It would have inflatable evacuation slides similar to those of an aircraft. Optional features could include sensors to keep it from colliding with a person or object (such as an over height vehicle in front), warning lights and safety curtains at the rear to keep drivers of over height vehicles from going underneath, repeater traffic signals underneath to relay the indications of traffic signals up ahead, and animated light displays to simulate stationary objects to prevent disorientation of drivers underneath.

Figure 13-14: Transit Elevated Bus

Source: New China

The idea is that the vehicle would not interfere with the regular traffic passing beneath it and to run trials to evaluate the vehicle's actual required braking distance, drag coefficient and power consumption, along with "the relationship between people and cars. The TEB could also be an excellent transit choice for a new city, where the infrastructure can be pre-planned to accommodate it[93].

Quantum Experiments at Space Scale (QUESS)

On 16 August 2016 China launched the world's first quantum satellite, which is designed to establish ultra-secure quantum communications by transmitting uncrackable keys from space to the ground. It is an international research project in the field of quantum physics. A

[93] Rain Noe, China Actually Builds That Transit Elevated Bus Concept!, Core77

satellite, nicknamed Micius or Mozi, after the ancient Chinese philosopher and scientist, is operated by the Chinese Academy of Sciences, as well as ground stations in China. QUESS is a proof-of-concept mission designed to facilitate quantum optics experiments over long distances to allow the development of quantum encryption and quantum teleportation technology. This satellite is designed to literally teleport information, to distances 1,200 km away. The initial experiment attempts to demonstrate quantum key distribution (QKD) between Xinjiang Astronomical Observatory near Ürümqi and Xinglong Observatory near Beijing – a great-circle distance of approximately 2,500 kilometres. Quantum teleportation is information traveling outside of space and time. Scientists have done experiments with quantum teleportation already, but testing quantum teleportation at extremely long distances requires going to space. It's the easiest way to set up laser communication between two distant points on the earth's surface. That's what the Chinese satellite, developed in cooperation with the Austrian Academy of Science, intends to do. Moreover demonstrating a super-long entanglement, the scientists working with the satellite want to test new communications technology. The field of quantum information is still in its infancy. As we continue to learn the fundamentals of how quantum phenomena work at a large scale[94]. QUESS will perform a test of Bell's inequality at a separation of over 1200 km – the greatest distance to date – to prove that entanglement can exist between particles separated by such a large distance. China is planning to launch a number of similar satellites to create a quantum communications network by 2030, QUESS is one of four missions belonging to the National Space Science Centre's strategic priority programme in space science[95].

[94] Tim Fernholz, China's new quantum satellite will try to teleport data outside the bounds of space and time, Quarz

[95] Elizabeth Gibney, Chinese satellite is one giant step for the quantum internet, Nature.com

Figure 15: China's quantum satellite containing a crystal that produces entangled photons

Source: Nature.com

Super Highway for clean power

China likes to do things on a grand scale, which allows it to serve its vast population and brag about its technical advancements. The country built a 800-kilovolt transmission line that will ferry wind and solar power over 2,210 Km and when completed in 2014 could claim a world record for its capacity of 8 GW, according to the Chinese government-run China Daily on Monday. The use of high voltage direct current (HVDC) technology is gaining popularity in a world dominated by electric grids that run on alternating current. HVDC equipment tends to cost more, but it also can be more efficient at transporting large volumes of electricity over long distances. This isn't the first project to use ultra high voltage direct current lines at 800 kV, which are state of the art. Both Siemens (s SI) and ABB (s ABB), two power line equipment makers, previously announced projects selling their 800 kV equipment to China Southern Power Grid and State Grid Corporation of China, respectively. The country installed a few giga-watts of solar power projects in 2011, and estimates from market analysts and Chinese solar companies have varied widely, from 3 GW to 7 GW. China also is the world's largest wind energy generating country. These developments have made the country a magnet

for U.S. tech companies[96]. Construction of an ultra-high voltage transmission line, which is set to carry wind and solar power across the nation, has started in 2012. The line boasts a world record energy capacity. The high-voltage power line installed now will help transmit the clean energy to eastern part of the country, that is economically more advanced.

Figure 16: Siemens 800 kV equipment

Source: Siemens

Robotics industry

Factories in China are replacing humans with robots in a new automation-driven industrial revolution. Thousands of factories in China are turning to automation in a government-backed, robot-driven industrial revolution the likes of which the world has never seen. By the end of 2016, China will pass Japan to be the world's biggest operator of industrial robots, according to the International Federation of Robotics (IFR). The pace of disruption in China is unique in the history of robots. The walk of the machines all around the world has been accelerated by the sharp falls in the price of industrial robots and a steady increase in their

[96] Ucilia Wang, China building super highway for clean power, Gigaom

capabilities. China is developing its own robot makers, but the cost of labour is rising and young people don't want to work on the production line like their parents did. Government cares the integration of ever cheaper and more efficient industrial robots is good news for factory owners in China, who are facing a weak global economy and a slowdown in domestic demand. And in this way the rise of automation means that industrialisation is likely to generate significantly fewer jobs for the next generation of emerging economies, indeed China itself is not immune from the negative consequences of automation. As China and other industrial leaders build more and better robots, the tasks they can take on will expand[97]. One of the most famous example is Jia Jia, presented at the World Robot Conference in Beijing. She is a typical oriental beauty with shiny hair, bright skin, a thin figure and a kind voice. More importantly, as China's latest interactive robot, she is considerate and humorous. Many other robots have charmed the audience during the conference, such as humanoid robots that can read emotions or write traditional Chinese calligraphy, and robots that can perform medical operations, wait at tables or work in factories. Remebot, China's first neurosurgery robot, was a hit at the conference. The designers said that it was accurate to just one millimetre, and with its help, brain surgery that used to take hours could be done within 30 minutes. China's robot shipments topped 68,000 sets last year, accounting for 26.7% of the global market. Asia has become world's largest supplier of industrial robots, taking up 60% of the global market. The National Natural Science Foundation of China announced plans at the conference to invest $29.5 million to support the study of the basic theory and key technologies of robots that can work alongside people[98].

[97] Ben Bland, China's robot revolution, Financial Times, 2016

[98] Xinhua, Robotics industry booming in China, English government

Figure 17: Jia Jia Robot at World Robot Conference, Beijing

Source: English Government

Figure 18: Robot draws a portrait of a visitor during the 2016 World Robot Conference in

Source: English Government

CHAPTER 4

THE COMPARISON

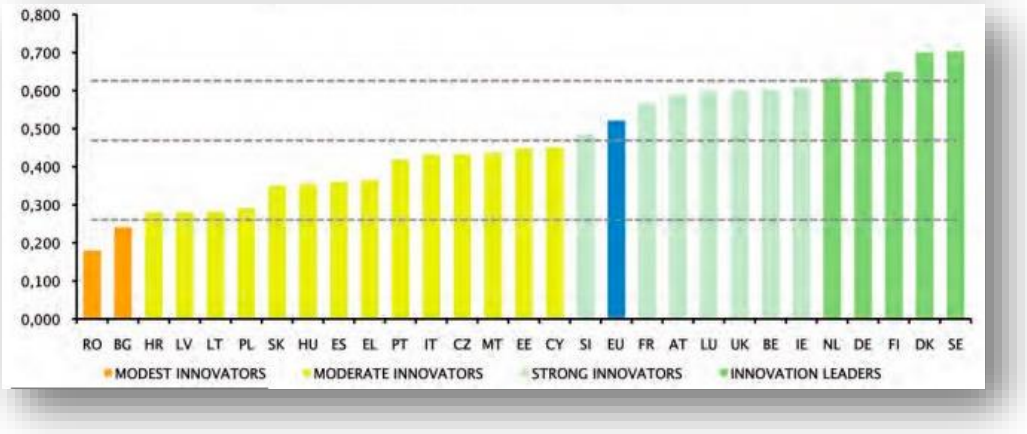
4.1 The Innovation System in China and Nordic Countries: Macro Background

China and Nordic countries (Sweden and Finland) are today among the leading nations in terms of gross domestic product and national R&D spending. In order to remain at the forefront of economic and technological development, decisive innovation strategies must be implemented: national strategies, private business strategies, coordinated approaches towards innovation. Sweden and Finland are export oriented market economies. Exports of goods and services amount to almost half of the GDP. Traditionally, the Swedish and Finnish business sector and industry have been commodity-based. On the other hand, China is an industrialising, upper-middle income country with major gaps and inequality between different regions. National innovation strategies in both countries are often characterised by similar strategies but also different, that may lead to greater competition and overlap. At the same time, innovation strategies may involve complementary activities and potential synergies for two countries. Sweden is doing particularly well in developing human capital and producing high quality academic research. Finland stands out by having favourable financial framework conditions relative to other countries in Europe. The European Innovation Scoreboard is published by the European Commission and is a comparative analysis of innovation performance in EU member states. But the analysis also comprises neighbouring countries and European countries that are not part of the union[99]. The Nordic countries are considered an innovation powerhouse in Europe, a solid number of Nordic figures have been able to raise significant capital and go beyond the early stage barrier. And the strong acceleration reported in the last two years supports this positive sentiment about the growth potential in the region. China's governance structure in science and technology is highly sophisticated. At its apex is the Chinese Communist Party Central Committee

[99] Vilhelm Carlström, Sweden, Denmark and Finland are the most innovative nations in the EU

(CCPCC), which leads science, technology and education through a Steering Committee of Science, Technology and Education within the State Council. This decision-making body is composed of all heads of the ministries directly involved in China's science and technology enterprise[100]

Figure 19: EU Member States' Innovation performance



Source: European Innovation Scoreboard 2016

4.2 Different Innovation Policies

China's innovation policy according to the EU Trend Chart Innovation Policy Classification System shows many differences between them.

Policy category: fostering an innovation culture

Nordic countries underline the importance of education and initial and further training, Mobility of students, research workers and teachers, raising the awareness of the larger public and involving those concerned, fostering innovative organisational and management practise in enterprises, public authorities and authorities and support to innovation policy makers and finally promotion of clustering and cooperation for innovation. On the other hand, China underlines some government policies and measures in these topics, like: regulations on

[100] "Comparison of the Innovation Systems in China and Germany", Joint Paper of the Expert Group of the Sino-German Platform Innovation

Academic Degrees (1980), Law on compulsory Education (1986), recent policy actions included the "211 Project" and a series of award and training programmes. Moreover the country introduced policies co-developed by Ministry of Education and Ministry of personnel to support foreign experts to work in China, to attract overseas Chinese students an scholars to return and to encourage the placement of PhD graduates in enterprises. Nevertheless the government offers tax incentives for intermediary S&T knowledge, indeed grants were provided to fund the project of increasing public awareness of S&T. China has also developed regional clusters under the initiative of local governments like Yangtze River Delta Initiative. With it, China hopes to build a world-class city cluster with global influence, forming new global competitive advantages and serving the construction of the Belt and Road Initiative and development of the Yangtze River economic belt. There's a need to further streamline administration, combining power delegation with enhanced supervision and optimizing public services, strengthen cooperation and report major issues, policies and projects involved in the plan[101].

Policy category: Establishing a framework conducive to innovation

In the Nordic countries what is relevant in this topic is: competition, protection of intellectual and industrial property, administrative simplification, amelioration of legal and regulatory environments, innovation financing and taxation. Regarding China's laws and measures introduced we can notice: Protecting Consumer's Rights and Interests Law (1993, Anti-Trust Law (2007), Trademark Law and Copyright Law. Indeed the state Intellectual Property office launched several projects, including the annual IP week campaign to strengthen public awareness of IPR protection and regulations to simplify administration in order to encourage the creation of technology-based start-ups. The innovation Fund for Small Technology-based firms was also established

Policy category: Gearing research towards innovation

The Nordic countries have thought strategic visions of research and development such as: strengthening research carried out by companies, start-up of technology-based companies, intensified cooperation by research, universities and companies, strengthening the ability of

[101]http://english.gov.cn/policies/latest_releases/2016/05/25/content_281475357156758.htm

companies to absorb technologies and know-how. From the Chines way of thinking we can see a Medium-long term S&T strategic Plan based on preferential taxes policies for some industry sectors were implemented. That's also why numerous national and local government policies aim to promote science parks and incubators and attract overseas Chinese set up start-ups in China[102].

By improving industrial agglomeration, strengthening the international cooperation, carrying out some high-tech industrial projects and constructing high-tech industrial value chains, the aim to form some industrial clusters with core competitiveness based on independent innovation will be achieved. Central Government agencies including the NDRC, MOF, MOST, and MIIT, have issued a large number of policies on industrial clusters in order to promote industrial innovation according to the National Outline for Medium and Long-term S&T Development Planning.

Tab 1: Agencies for cluster policy implementation in China and Nordic Countries

China	Nordic Countries (Finland- Sweden)
Main agencies responsible for policy implementation: National Development and Reform Commission (NDRC) Ministry of Finance (MOF) Ministry of Science and Technology (MOST) Ministry of Commerce (MofCom) Ministry of Industry and Information Technology (MIIT)	**Main agencies responsible for policy implementation:** National Technology Agency (TEKES) Science and Technology Policy Council (STPC) Finnish Innovation Fund (SITRA) National Research and Development Centre for Welfare and Health (STAKES) Technical Research Centre of Finland (VTT) Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS) Swedish Council for Working Life and Social Research (FAS) Swedish Agency for Innovation Systems (VINNOVA)

[102] China, OECD Reviews of Innovation Policy

Due to China's cluster policy, industrial clusters have achieved a stable rapid growth. However, most of the industrial clusters in China are still far from a true industrial cluster, which is just industrial agglomeration. The Central Government and local governments need further coordination, cluster-specific organisations and the establishment of governance mechanisms. In this topic, MOST is helping, being an overarching government agency overseeing a major part of the nation's S&T enterprise. It is responsible for a wide range of functions from the formulation of S&T policies, plans and programs to the allocation of the S&T budget. It focuses on innovation policies and has issued a series of policies to promote the development of high-tech industrial clusters, especially high-tech industrial parks[103]. The Chinese Academy of Sciences (CAS) acts as the premier institution governing China's research system with multiple research missions in civil as well as defence-related areas. CAS is also involved in high-tech industrialization, technology transfer in education and training.

4.3 Which are the main differences?

4.3.1 Sweden and Finland

The Nordics cluster at the top of league tables of everything from economic competitiveness to social health to happiness. They have avoided both southern Europe's economic breakdown and America's extreme inequality. Nordic politician often offer a plan of how to reform the public sector, making the state far more efficient and responsive[104]. Moreover Finland and Sweden are the biggest spenders in R&D in all Europe with the highest share of private investments. All Nordic countries offer equal educational opportunities for all citizens, and invest in training all the way up to pension age. All these countries have introduced entrepreneurship courses in their education programs. Both Sweden and Finland are Innovation Leaders according to the European Innovation Scoreboard 2016, even if they decreased their performances in 2015. Both are performing above the EU average for all dimensions. Performance in nearly all of the indicators is also above the EU average,

[103] "Comparison of the Innovation Systems in China and Germany", Joint Paper of the Expert Group of the Sino-German Platform Innovation

[104] http://www.economist.com/news/leaders/21571136-politicians-both-right-and-left-could-learn-nordic-countries-next-supermodel

especially in International scientific co-publications, Public-private co- publications, License and patent revenues from abroad, and PCT patent applications (in societal challenges)[105]. Nordic countries put innovation in evidence in their industrial policies and this choice is revealing the best one. More than 6,5 billions of investments have been collected from innovative firms: digital media, gaming together with finance and hardware are the most relevant. In Helsinki, there's an event called Arctic15, which is the first pan-European platform born with the aim of transforming the European start-ups to scale-up putting them in contact with the big international firms. The analysis focused on ICT scale-up of the five Nordic countries (Denmark, Finland, Sweden, Iceland, Norway and Sweden) shows a young and rich ecosystem. Sep (Startup Europe Partnership) identified 430 ICT scale-ups (A scale-up is a business looking to grow/expand in terms of: market access, revenues, added value or number of employees) in the five countries which have collected 6,5 billions dollars. The 60% of them have been founded after 2010: this means that the environment is undeveloped and the numbers can be even more appreciated. Innovation here is at the top, these countries have an industrial structure and GDP pretty reduced in comparison with all the other of Europe and they also have more capacity to create successful firms. This means that applying structural policies, which support innovation, will lead to important results. Sweden is the mayor hub for scale-ups with 149 firms (36% of the total), Finland is at the second place with 126 (29% of the total). Nordic countries' scale-ups have collected on average 15 millions each and on the top of the rank there's Sweden with 3,4 billions, this thanks to the billion fundraising realised by the local unicorn, Spotify. Gaming sector represents the real strength in this ecosystem: 40 scale-ups have been constituted with 0,9 billions of capital raised. Other sectors which demonstrated to be significant are finance, with 25 scale-ups, which collected 0,7 billions and hardware with 36 scale-ups and 600 millions collected[106]. Eurostat declares that in Nordic Countries the expenditure in R&D relates to GDP have the best results and also that they also have the best universities (after England and Germany). Finnish research system is centralized as regards strategies, guidelines and financing, but regions has a local autonomy for the implementation of policies. At the peek of governance there's the parliament and

[105] European Innovation Scoreboard 2016

[106] Andrea Frollà, Innovazione, Nord Europa patria delle scale-up: al top Svezia e Finlandia, Corriere Comunicazioni

government, which are supported by Research and Innovation Policy Council (RIC) headed by the Prime Minister who helps in order to give advices to strategic development and coordination of science and innovation policies. Then there are some ministers (Education and Economy) who manage 87% of financing for research, followed by some agencies like Tekes and Sitra, which finance both based and applied research in a competitive way. At the very last step of governance structure of research there are universities and organization of public research. With this kind of system and evidence-based approach to political decision, what matters are the valuation processes. On the other hand, Sweden has two relevant documents in this field: the Research Bill, written every four years, suggests allocation and the agenda for public research and then there's National Innovation Strategy, which establishes the line guides for innovation policies regarding Horizons 2020. Both of these documents are realized with a meeting of involved stakeholders. The organization system is based on bottom-up type, this means that is influenced by the different actors of the several Ministries. These last actors empower lots of controls to specialized agencies like Swedish Research Council. It is in charge of based research and the scientific communication to public. These agencies carry out a support and advice role for ministries through annual reports. The Swedish Research is based on the Research Bill: attracting qualified people from abroad, supporting young people, increase funds to special projects leaded by groups. The 51% of public funding is distributed on a competitive base, on the other hand the institutional one passed through a lot of reforms. In 2014, the Swedish Research Council proposed a new funds' distribution model based on two indicators: publications and external financing. It's working collaborating with Vinnova in order to include also the peer-review in this model[107]. Research and innovation (R&I) policy plays a key role in efforts to create sustainable growth and well-being. Globalization, technological progress and higher competition contribute to put pressure in order to create more knowledge and transform it into innovation. These new factors are concerning Nordic countries, even if they are the most competitive in Europe. They are not excluded by these new challenges, indeed they are studying new solutions that can allow to maintain their already excellent results. They invest a lot in research but they are so little at global level that they have to constantly verify if their efficacy balances their dimensions. The Nordic environment for research and innovation (Nordic Research and

[107] Michele Bellone, Svezia, Danimarca e Finlandia. Le eccellenze della ricerca europea, Oggiscienza

Innovation Area, NORIA) could be enforced thanks to the gradual openness of national programmes of R&D. They should decide to open reciprocally their own financing programmes allowing everybody's requests, but they prefer other solutions:

- Analysis and planning of needs
- Invitation to present different proposals
- Invitation to present proposals by a virtual common entity in order to face just national requests.

NordForsk and Innovation Nordic Centre (NICe) are the actual responsible institutions in order to realize policies for research, but they don't have any contact between them. This means that there's a lack of a research government procedure that could allow the development of policies for innovation and research[108].

Figure 20: 2012 Index rankings

Overall rank*	Country	Global competitiveness	doing business	Global innovation	Corruption perceptions	Human development†	Prosperity
1	Sweden	4	13	2	4	10	3
2	Denmark	12	5	7	1	16	2
3	Finland	3	11	4	1	22	7
4	Norway	15	6	14	7	1	1
5	Switzerland	1	28	1	6	11	9
6	New Zealand	23	3	13	1	5	5
7	Singapore	2	1	3	5	26	19
8	United States	7	4	10	19	4	12
9	Netherlands	5	31	6	9	3	8
10	Canada	14	17	12	9	6	6
11	Hong Kong	9	2	8	14	13	18
12	Australia	20	10	23	7	2	4
13	Britain	8	7	5	17	28	13
14	Germany	6	20	15	13	9	14
15	Ireland	27	15	9	25	7	10

Source: The Economist

Three, so-called lighthouse, projects have been identified by The Nordic Cooperation Programme for Innovation and Business Policy 2014-2017. They have been approved by the Nordic Ministers of Trade and Industry. Nordic Innovation is still working on the content of

[108] http://cordis.europa.eu/news/rcn/26507_it.html

the projects:

Innovative Nordic Welfare Solutions

People is aging and this is a problem that has to be faced. The health system should solve it and put health and welfare in the innovation policy agenda. All the Nordic countries see opportunities for innovation and market shares in the global economy in this field. While the public healthcare sector is not a protagonist in the innovation ground, it is necessary for the public health to become more innovative and to adapt new solutions to solve future challenges. It is intended to both develop better public services and contribute to the development of the Nordic supplier industry with the aim of export to the rest of the world.

Nordic Built Cities

This consists of six independent competitions, in which six Nordic cities are looking for innovative and multidisciplinary solutions to urban challenges connected to a specific urban space. An open, multidisciplinary competition to develop innovative solutions for Nordic urban challenges connected to a physical place – in a smart, liveable and sustainable way. This considering the 10 principles which represent the strengths and aspirations of the Nordic approach to make liveable, smart and sustainable cities and buildings.

Innovative Nordic Digital Solutions

In order to meet tomorrow's challenges, the Nordic Ministers of Business and Innovation have set the ambitious goal of developing the Nordics into a pioneering region for new and innovative digital solutions. Today, they are strong in the digital area, they have good infrastructure, sound public data and a high level of trust in the public sector. Ranked at the top in innovation and the countries have an extremely talented pool of entrepreneurs. But a pioneer does not settle for status quo, she explores. The project is to develop a single Nordic digital market and support innovative digital solutions that will improve the life of citizens and the effectiveness of doing business in the region.

4.3.2 China

China has maintained very rapid economic growth and development over several decades, but it now faces the challenge of ensuring that further progress – economic, social and environmental – will be both sustainable and comprehensive. This will require fostering innovation, which can play a major role in achieving that goal. Economic reforms prepared the ground for the Chinese economy's nearly three decades of extraordinary performance. China's re-emergence as a major power in the world economy is one of the most significant

developments in modern history. Structural change in the Chinese economy is broadly characterised by a shift from agriculture to services, with shares that are still significantly larger and smaller, respectively, than those of OECD countries. Unlike some developing countries, including some emerging economies, China has not started to de-industrialise but has strengthened its manufacturing base[109]. It's a long time that China has a special request made to the European Union, it wants to be identified as a Market Economy. The country was known in the entire world as the land of low-quality manufacture with a very low price but now it's becoming an Innovative Centre. The last Five-Year Plan affirms its policies based on innovation and the reason for this change is that China needs to innovate. Traditional strengths are getting weaker, this also due to the One-Child policy, which has lead to the fact that workers are not increasing and the huge debt. Moreover, the competitiveness of "Made in China" is decreasing thanks to the introduction of Industry 4.0. Innovation is an obliged choice and also a national challenge for China, which can be realised in places with big universities and research centres. But these are not the only players in this field; in China the central government establishes general guidelines but the locals ones have a great autonomy to decide how to act. Local Governments have a lot of different tools to sustain innovation in their cities. For example, Shanghai Government approved a new schedule in order to refund investors for the 60% of eventual losses caused by investment in technological start-ups in Shanghai. Local governments' help to innovation can be measured with their expenses in science and technology, and it's recognised that the public expense in these subjects has grown a lot in this last period. In the first steps, innovation hubs tend to be research and innovation centres with different ranges then, in a second moment they verge to specialize and excel in few sectors where they have better results. Beijing is known as a leader in biotechnology and biomedicine, high-tech sectors and it represents the most important innovation hub in China. The innovation process is not without obstacles, indeed it arises from new ideas, and the question now is : why a person with a new idea should develop it in a place where everybody can easily copy it? The lack of protection of intellectual property is a challenge that the Chinese government has to face if it wants to transform the country in a global innovation leader. Indeed foreign firms hesitate to transfer technology to China; the threat of IPR violation may even limit their willingness to produce in, or even to export goods

[109] China, OECD reviews of innovation policy, OECD

to China. As regards investors, one of the main problem is the lack of transparency and reliable information, this makes hard to local companies to overcome the very first steps (financial analysis). If China could face this problematic, it has the chance to do better also than USA[110]. Recent policy initiatives show the government's determination to step up investment in science and technology and build a high-performing national innovation system. The overarching goal is to make China an "innovation-oriented" society by the year 2020 and one of the world's leading "innovation economies". Large state-owned banks dominate China's financial system and their business largely consists of giving loans to large SOEs (State Owned Enterprises). As many of these SOEs have been operating at a loss, large amounts of non-performing "bad" loans have accumulated. China's financial system has to reduce the level of non-performing loans and to reform the governance of China's banking system in order to avoid the accumulation of new bad debt in the future. The conditions are improving with the reform of the SOEs, the gradual opening up of China's banking system to foreign competition in connection with the country's accession to the WTO, and measures to improve the governance and professional supervision of the banking system. China's financial system does not meet the funding needs of SMEs. The capital market is underdeveloped and SMEs find it difficult to secure loans since banks favour large companies, particularly SOEs. Smaller, privately owned firms thus largely depend on self-funding. Recent initiatives to address this issue propose funding mechanisms to support science and technology and innovation activities. There is also a strict lack of capital for financing new ventures, which are known to be an important source of innovation. Domestic venture capital firms have been set up by the government, at national or provincial level, and are run by government officials who do not always have adequate technical, commercial or managerial skills. China's National Innovation System is not completely developed and still not perfectly integrated, with many connections between actors and sub-systems remaining unfortunately weak. It looks like a very large number of innovative firms with limited synergies between them and, above all, limited spillovers beyond them. A relevant objective to realize now should be spreading the culture and means of innovation beyond the fences of S&T parks and incubators by promoting more market-based innovative clusters and networks. China plans to continue to increase R&D spending while at the same time promoting more market-led innovation. To do

[110] Pietro Gagliardi, Gli Hub di innovazione Cinese

so without extending the efficiency gap will present a challenge since the level of business R&D will be increasingly determined by the profitability of such investment. Besides the higher education system has expanded considerably over the last decade. Several institutions are recorded as active in R&D because they receive some relevant public support and compared to other OECD colleagues, China has two main distinctive features: a greater relative number of enrolments in science and engineering disciplines, which provide a larger basis for related research activities and a strong orientation concerning applied research. For university research, government policy has aimed at concentrating increased funding on the universities that were considered to have the greatest potential for developing research and performance. The problem here is that inter-firm innovation-oriented collaboration, within clusters, remains occasional outside S&T (Science and technological) industrial parks (STIPs) and university science parks and, as already seen before, foreign firms have developed few links with domestic firms. Industry-science relationships (ISRs) are at the heart of the most innovative networks. They are prevalent in the most advanced economies and take many forms like: casual contacts between academic scientists and engineers, spin-offs from public research, licensing and patenting by universities, contract research, mobility of researchers, public-private partnerships for research, co-operation in training and education, etc. The fact is that ISRs in China suffer from insufficient demand from firms, low mobility of researchers, and competition between public research and industry for public support. China has already introduced many of the policy instruments used by OECD countries. However, all of these policy instruments are characterised by a top-down approach in their design and implementation, with little influence from other stakeholders, especially the private sector. This approach verges to have implications for the way of implementation and the effectiveness of policy instruments. China is developing rapidly from an agricultural economy to a dual economy in which a modern, high- technology industrial sector co-exists with a still relatively large agricultural sector[111]. It has used constant globalization processes in its favour, it benefited from the relocation of production facilities by multinational companies that tried to reduce their cost structure. Nevertheless low-cost manufacturing was the prime mover during the 1990s, China developed absorptive capacities and was able to gradually move up towards higher value-added activities. China's production and export structure thus has

[111] China, OECD reviews of innovation policy, OECD

gradually shifted towards high-tech manufacturing products. While high-tech goods from China still accounted for only 4.1% of world high-tech manufacturing value added in 2000, this share has increased to 18.8% in 2010. ICT represents one of the most dynamic industries in China: telecommunications operators and manufacturing, as well as internet companies are the most obvious examples. China is the most important manufacturing location for ICT products and it has become the world's largest exporter of ICT products since 2004, even though its comparative advantage is still low for some advanced products. Chinese ICT exports are still primarily low value-added commodities produced in large quantities and with a low-margin. Its short history of industrialisation implies quite short experience with S&T policy making at all levels of the Chinese government. The lack of government capacity to make and implement such policy creates a block, as policy makers have had little experience in promoting innovation. The main question remains: what China should improve in order to be really competitive in this innovation world? There should be an adjustment of the role of the government, in his participation and collaboration for the creation of innovation. Indeed there are some modification at the government level that should be done:

- Government should be encouraged to modify its attitudes and methods of work, giving a greater role to market forces, competition and the private sector, and to encouraging actors throughout the national innovation system to adopt a more market-/demand-oriented attitude and behaviour.
- Improve the role of government in the delivery of public goods. The role of government should be developed in areas characterised by a prevalence of market and market failures. The Ministry of Science and Technology (MOST), together with other authorities, should pay more attention to developing policy measures that deal with disparities and the delivery of public goods through science and innovation, including to address social and ecological issues.
- Government innovation policy should put more emphasis on the creation of framework conditions conducive to innovation, while maintaining and developing dedicated policies aimed at supporting R&D and innovation in both the public research and the business sector.

The Chinese economy is now the world’s fourth largest and macroeconomic performance is strong. China will need to improve the framework conditions for innovation, including good corporate governance and a modern and pro-competitive regulatory regime, in order to

strengthen the basis for long-term growth. For China, more can be gained by following a long-term, coherent strategy to build its own capabilities than by attempts to accelerate technology transfer artificially.

Figure 21: Comparative performance of National Innovation systems

Source: Innovation Policy Platform

From Figure 21, (taking into account that Finnish results are pretty similar to the Swedish ones) we can see a sort of supremacy of the Nordic countries compared to China. In each field: Public R&D expenditure, Top 500 Universities, Publications, Business R&D expenditures, Top 500 corporate R&D, Triadic Patents, Trademarks, Venture capital, Young patenting firms and ease of entrepreneurship index, Nordic countries have better results. This results from the fact that Swedish and Finnish policies continue to be strongly focused on the need to build new "high-tech" industries and on the role of university science. All the Nordic countries have developed new policies for the university sector (education), partly in order to improve the interaction with industry. Their governments are working on initiatives to strengthen the innovative capacity of the business sector. This includes stimulating needs-driven research and increased innovative capacity, and providing support for commercialisation where private market mechanisms have a limited effect. A not irrelevant

problem is the low level of internationalization characterizing these countries, affecting both the public and private sectors. They have to internationalize their innovation activities and national science and technology institutions. Moreover, innovation policies must now go beyond economics and include societal development. On the other hand, since China is known in the world as the land of low-quality manufacture with a very low price, it has to work out in order to acquire the image of an Innovative Centre. Local governments' are helping to innovate and their expenses in science and technology can measure this, but there are still the problem of lack of IPR and the direction of funding just to SOEs and not SMEs. China's NIS is not wholly developed and integrated, it is characterized by many connections between actors and sub-systems, which are remaining unfortunately weak. The image of China shows a very large number of innovative firms with limited synergies between them and with limited spillovers.

CONCLUSION

The need to innovate has become crucial in this new competitive world, this means also face the new challenges and be aware of the change that is taking place in business sector. That's why Government intervention is needed to manage the problems and to increase innovation in industries. Its influence on the innovation process would be significant and it should assume risks in the long-term vision in order to fix market failures. With its support, it would help the new developments through changes in the business environment and often industries take the role of universities in developing training and research at the same high level as universities. Innovation concerns not only the entrepreneur but also the whole society. Many governments' interventions seek to increase the efficiency of industrial processes and to stimulate innovation. Europe has already intervened through some initiatives in order to create a smart, sustainable and inclusive economy: Innovation Union with its instruments monitors the situation across EU. As regards the Nordic countries, we have seen, as Sweden and Finland are the biggest spenders in R&D in all Europe. The Scandinavian area is considered a Unicorn Factory due to the excellent results reached in innovative solutions and products in several industrial fields. The innovative capacity to understand the new market's needs, makes these countries leaders in innovation, according to the European Innovation Scoreboard 2016. All this is sustained by a consistent cash flow in R&D investments (3,7 % of GDP) in different subjects like: ITC, BioTech, CleanTech. This ecosystem owes several local investors (angels, super-angels, family offices, crowd funding, hubs and corporate ventures) this development and international actors, who understood the potential. This region offers numerous chances due to competitive and dynamic business environment but also because it owns the title of being the world leader in transforming technology in products. Its' the first European centre for new start-ups births, just after Silicon Valley. It also surrounded by several clusters for ICT development having great experience in different projects, that's why it's one of the most interesting places where invest. All this was possible thanks to government's innovation plans based on free education for everybody and the creation of a start-up community, together with a global approach (not just local) and a problem solving way of thinking. Scandinavian's tech scene has developed over decades into what today is a world-class, mature start-up hub There's an endure introduction of structural reforms, maybe a bit too slowly but persistently. All this is done without sacrificing what makes the Nordic model so valuable: the ability to invest in human capital and protect people from the disruptions that are part of the capitalist system.

On the other hand, China has transformed itself from a planning to a market-oriented economy over the past three decades and has sustained a fairly long period of rapid economic growth, to which the contributions from innovation in science and technology (S&T) have become increasingly important. China has shifted its S&T and industrial policy-centered innovation strategy and has followed a series of better coordinated, innovation-oriented economic and technology initiatives that give greater attention to a portfolio of policies that include critical financial, tax, and fiscal measures. Chinese government's policies aim to sustain the competitiveness and growth and they are transforming the land of "low cost and quality manufacturing" in a centre of innovation. Innovation arises in urban communities with good universities, R&D centres and rich investors and it has started from the up, which means thanks to Government. It operates centrally giving general guidelines, and then the local ones have the possibility to modify them. Once the ecosystems helps the new births of start-ups, they just need to be financed. The lack of IPR, for this reason, is probably the biggest challenge that the Chinese Government has to face. As regards investors, the main problem is the lack of reliable information and transparency, but also the fact that it's hard to grow through Stock Exchange because of Chinese Securities Regulatory Commission, which takes years to create a bid. China understands the pressing need to innovate, creating several innovation hubs and also the necessity of government's help, using public venture capital. Indeed China is spending 2% of GDP and is focusing on Beijing technological and scientific hubs within 2030. At the moment, the capital is hosting 19 unicorns start-ups. The main aim is to increase the world competitiveness and if it will face its challenges it could overcome anybody in the innovation competition. China works in the innovation context fiercely believing in the realization of Grand Challenges with huge investments given to SOEs like: TEB, QUESS and Robots, which means especially high-tech and engineering fields. Thanks to these projects, it is becoming a country, which doesn't copy or produce outcomes characterized by low quality but a global power for innovation.

BIBLIOGRAPHY

A.G. Lafley and Ram Charan; The Game Changer, April 2008

Anders Lundström, Entrepreneurship policy in the Nordic countries – perspectives of the development since 2003

Antonio Tajani, Innovation, an insight from Europe, European Commission

Chad Brooks, Innovation: Key to Successful Business, Business News Daily Senior Writer

Charles Edquist, Leif Hommen, Small Country Innovation Systems, Globalization, Change and Policy in Asia and Europe

China, OECD Reviews of Innovation Policy

China, OECD reviews of innovation policy, OECD

Communication from the commission to the council, the European Parliament, The European economic and social committee and the Committee of the Regions

David Bray, Building 'Community': new strategies of governance in urban China

David Wertim, It's Official: China is becoming a new innovation powerhouse, FP

Esko Aho, Report of the independent Expert Group on R&D, Creative an innovative Europe

European Commission ,Innovation Union – A pocket guide on a Europe 2020 initiative

European Commission, COM (2006) 502 final, 13.09.2006

European Innovation Scoreboard 2016

Feng-chao Liu, China's innovation policies: Evolution, institutional structure, and trajectory, Elsevier

Fulvia Montresor, These 3 things make a company truly innovative, World Economic Forum

Hedin, Alexandre Dubois, Riikka Ikonen, Kaisa Lähteenmäki-Smith, Jörg Neubauer, Katarina Pettersson, Daniel Rauhut, Veli-Pekka Tynkkynen & Åke Uhlin, Regionally Differentiated Innovation Policy in the Nordic Countries – Applying the Lisbon strategy, Nordregio report.

Jan Fagerberg and Morten Fosaas, Innovation and innovation policy in the Nordic region**,** NordMod 2030. Sub-report 13

Jan Fagerberg, Schumpeter and the revival of evolutionary economics: an appraisal of the literature, Journal of Evolutionary Economics

Jeffrey H. Dyer Clayton M. Christensen, The Innovator's DNA, Harvard Business Review 2009

Karol Śledzik, Schumpeter's view on innovation and entrepreneurship

Mari Hjelt, Pim den Hertog, Robbin te Velde, Mikko Syrjänen, Major challanges for the governance of national research and innovation policies in European countries, Tekes

Maria Anvret, Massimiliano Granieri, Innovation Policy: Boosting EU competitiveness in a global economy, CEPS Task Force Report

Michele Bellone, Svezia, Danimarca e Finlandia. Le eccellenze della ricerca europea, Oggiscienza

OECD Reviews of Innovation Policy: Norway

Per M. Koch, Innovation Policy in the Nordic Countries 2004, Trend Chart Nordic

Philipp Boeing, Philipp Sandner, The Innovative Performance of China's National Innovation System, Frankfurt School – Working Paper Series

Pietro Gagliardi, Gli Hub di innovazione Cinese

Politica dell'innovazione: aggiornare l'approccio dell'Unione europea nel contesto della strategia di Lisbona, EUR-Lex

Richard Herd and Sean Dougherty, China's economy: A remarkable transformation, Observer OECD

Ryan Allis, How to Innovate, The Startup guide

Slobodan Cvetanović, Danijela Despotović, Igor Mladenović, The concept of technological paradigm and the cyclical movements of the economy

Soumitra Dutta, Bruno Lanvin, and Sacha Wunsch-Vincent, The Global Innovation Index 2015 Effective Innovation Policies for Development

The international dimension of research and innovation cooperation addressing the grand challenges in the global context, European Commission

Tomas Åström Faugert & Co Utvärdering AB, Monitoring and analysis of policies and public financing instruments conducive to higher levels of R&D investments The "POLICY MIX" Project

Veronique Clement, Finland's economy and innovation sector, Ambassade de Finlande

Wiley, Strategic Innovation Management

Xielin Liu, Steven White, Comparing innovation systems: a framework and application to China's transitional context, Elsevier

Xinhua, Robotics industry booming in China, English government

Xinhua, The rise of China's innovation, Shanghai Daily

Ying Zhou , Regional Innovative Capacity in China: From the Perspective of Embedded Autonomy, USF Scholarship Repository

SITOGRAPHY

www.china.org

www.coe.int

www.cordis.europa.eu

www.economist.com

www.english.gov.en

www.eu2006.fi

www.eua.be

www.europarl.europa.eu

www.government.se

www.innovationpolicyplatform.org

www.insme.org

www.oecd-ilibrary.org

www.oecd.org

www.stratfor.com

www.vinnova.se

www.weforum.org