DIGITAL TRANSFORMATION, INNOVATION AND ECONOMIC PERFORMANCE: A COMPARATIVE STUDY OF FINLAND AND INDIA

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ABSTRACT

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Abstract
Transformations in the information and communication technologies has had a profound effect on innovation and in turn the economic growth within countries. These changes have already been reflected in the corporate environment by improved market mobility and compounding profitability of corporations. These quantum leaps have been well drafted in literature studies and various other international reports. However, the standpoint of the government at the national level and their approaches to facilitate these digital innovations has been subjected to limited research. Thus, this study primarily aims to shed light on what approaches have been taken by the governments and how have these approaches evolved so as to integrate and facilitate digital transformation and innovation to drive economic growth within the country. This study takes a comparative approach by comparing innovation policies in a developed country, in this case Finland, and a developing country, India, for a period of 15 years from 2002 until 2017.
The research literature builds on the national innovation systems framework to guide this study. Secondary data in the form of official government reports from both countries was made use of. In particular 22 reports from Finland and 16 reports from India were analyzed.
The results show a detailed view of the various actors involved in forming the national innovation system in both countries. Furthermore, they also showcase the different ways in which the policy makers have responded to technological and economic changes, the various programs initiated by them in order to empower the citizens, businesses and research institutions. Interestingly, both Finland and India at certain time periods can be seen to cope with similar challenges and both portray incremental and radical changes; the only difference being in their ability to firmly implement these changes. Eventually, the findings also suggest that both of these countries still need to work hard to better exploit their inherent capabilities to stay competent and competitive.

Key words
Information and Communication Technologies, Innovation, National Innovation Systems, Innovation Policy

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1 INTRODUCTION

1.1 Research Overview

The term innovation is always and most often used in synchronicity when referring to Schumpeter and his theory of innovation as an enabler of creative destruction for economic development (Schumpeter 1934). From a firm level context, innovation is a series of activities and their consequential interactions in a value chain. Likewise, it also plays an influential role from a national perspective because it improves productivity and output (Shyu et. al 2001; Xiao et. al 2013).

In the former era from 1960s till the late 90s, innovation was only thought to come about from tangible outputs in the manufacturing sector. Additionally, it was believed that innovation only resided with the advanced and developed countries since they had the means to provide for the infrastructure required. However, this sentiment no longer can be relied upon in the new innovation landscape which has been brought about as a result of globalization, technological advancements, liberalization and upliftment of emerging economies (Chang et. al 2006; Kiss et. al 2012; Li and Kozhikode 2009). These emerging or developing economies are "defined as those countries experiencing a rapid pace of economic development and where the government policies favor economic liberalization and a free-market system" (Hoskisson et. al 2000, p.249).

With digitalization in today's economy, information technologies are integrated into industrial processes and services attenuated to customer needs, human development and market growth. There is an increasing push for an omnipresence of internet connectivity and diffusion of web-based services into diverse spheres of activity within the countries. Compared to the industrialized nations, China, India, Vietnam, Brazil, Russia have garnered attention and have become the fastest growing markets post the 2008 financial crises (Holtgrewe 2014). Digitization, artificial intelligence, biotechnology, robotization, automation of transport and logistics, industrial internet etc. are a few of the technological innovations that are derived from the rapid growth in information and communication technologies.

Interests in understanding the role played by innovation in developing countries has led to extensive literature studies in comparing developing and developed countries. This has in a way focused the spotlight on how innovation determines global competitiveness of economies and their subsequent economic

growth (Avgerou 2008; Porter and Stern 2001). Additionally, various international reports have developed rankings by assessing the innovative environment and technology adoption capabilities of the countries (World Economic Forum 2008(b)). However, it needs to be kept in mind that innovation is only one of the critical factors to drive competitiveness and economic growth and merely comparing innovation activities between developing and developed countries cannot be only relied upon. Knowledge, more specifically intellectual knowledge, is the key factor of development in modern economies (Davenport and Prusak 1998) and eventually a knowledge-based society "where knowledge and competence constitute the foundation for education, and the crucial element in production, with information and communication technologies comprehensively supporting interaction, the dissemination and exploitation of knowledge between individuals, businesses and other communities, plus the provision and accessibility of services. The knowledge society produces commodities of high knowledge value"(Loikkanen et. al 2009, p. 1179).

To transition an economy into the current knowledge-based society requires governments to adopt changes in policies, directives and a structural readjustment of traditional methods and long-term plans. Therefore, it is important to find out what changes have been introduced in the government policies, especially the innovation polices. How have these changes contributed to the overall national development within the country?

The aim of this thesis is to compare and understand the approaches taken by governments of the countries to integrate and facilitate innovation and digital transformation to drive economic growth. This comparative approach also calls for observing the actions in a stipulated time period. Using Finland as one of the countries is justified because it has consistently been placed in the top spots of all the world rankings for competitiveness and innovation. Additionally, it is also known for its technical competence, highly skilled labor force, a frontrunner in education and a developed and well-functioning economy. On the other hand, India is a competitive emerging economy having a strong foothold in the technology sector and an enormous labor base. Being a developing country, it is undergoing reforms in major sectors to accommodate the changes happening in the world.

To determine the rate of innovation in a country and its influence on economic growth most of the research literature has made use of measures like R&D expenditure, number of patents filed, foreign direct investment and GDP. However, the theoretical framework in this study makes use of the national innovation systems literature. Understanding the national innovation system

concept is crucial to be able to make sense of the functioning of the national systems in the respective countries (Balzat and Hanusch 2004). Thus, this thesis has the potential to contribute to the literature on innovation and innovation systems by comparing the evolution of the innovation systems and changes introduced in the innovation policies in Finland and India.

1.2 Need for Information and Communication Technologies Context

The information and communication technology (ICT) sector is one such sector that is most symbolic of progress across society and innovation, both technological and economical. This sector is continuously developing a significant percentage of technologies that can be seen to visibly change work and life throughout societies and economies. Therefore, it is said that practices of technology use, employment and work organization in this sector lead to developments in other sectors (Chandrashekar 2001; Holtgrewe 2014).

The rapid diffusion of the ICT technologies in the economic system can be seen in the last two decades. The technologies have commenced from the accelerated developments in the semiconductor industry, the telecommunication sector, and more recently, a wide range of services linked to multimedia and internet (Castellacci 2006). ICTs have not only brought together companies and industries in the value-added web but have also given countries the opportunity to be linked together within a global network model. Additionally, enterprises based on ICT capabilities are thought of as important drivers to achieve innovation and economic growth (Han &McKelvey 2008).
The largest contributions to productivity, profitability and growth in an economy have come from the application and utilization of information and communication technologies not only on a corporate level but also a governmental one. Moreover, the developing economies have been progressing at a faster pace than the industrialized nations with respect to the digital transformation (International Telecommunication Union 2017).

In many industrialized nations, the global digital transformation is referred to as the *Fourth Industrial Revolution* or *Industry 4.0*. This set of transitioning technology systems has been placed high on the global agenda by the OECD countries in order to reap benefits for innovation, growth and social prosperity. From the year 2010, growth in telecommunications has been driven by customer demand and so consequently there has been an increase in investments and adoption of regulatory frameworks that incite competition. This in combination with data driven innovation has led to a change in the workings of organizations, corporations, cities and governments (OECD 2017).

However, there is a worrisome gap between utilization of technology and public sector engagement that is attributed to a shortfall in governmental readiness.

The OECD report (2017) iterates that the rate of digital innovation in corporations and small medium enterprises is swiftly progressing as compared to the rate at which it is being integrated into the government system. In order to stay competent globally, considerable efforts at the national level need to be employed. It is also important to keep in mind that from a government standpoint, the emerging digital transformation needs to be properly channeled and designed so as to achieve broad based gains. This in turn would pave the way for maintaining and sustaining innovation, growth and global competitiveness among economies. Therefore, it is crucial to understand the proactive efforts taken so far, what the effects were and what will be done for the future.

2 LITERATURE REVIEW

2.1 National Innovation Systems

In the 21st century, the economic developments in the world majorly rely on production, diffusion and knowledge dissemination. To ensure and sustain competitiveness, innovation based on knowledge and information has become imperative and so it is necessary and extremely important to understand the role of innovation in competitiveness and the development of the economy.

Numerous studies by scholars have mentioned that there is a complex bilateral relationship between individual aspects of a knowledge innovation system. In 1982, Freeman, for the first time introduced the concept of national innovation system (NIS). His paper, also known as the Washington Consensus, was designed as a response to "help develop an alternative analytical framework to standard economics and to criticize its neglect of dynamic processes related to innovation and learning when analyzing economic growth and economic development." (Lundvall 2007, p.96)

Wang et.al (2018) in their study note that the response was also aimed at the neoclassical approaches to growth. They further point out that innovation can not only be regarded as a work of individual businesses but a joint push that requires distinct sets of know-how and knowledge reserve. Since different countries vary in their capabilities for innovation, the concept of national innovation system, unlike the neoclassical approach, postulates that governments and supporting organizations possess the ability to play a vital role in the creation and dispersion of innovation in a national economy. Lundvall (2007) illustrates that the national systems of innovation come under the family of evolutionary economics. In evolutionary terms, innovation systems can be defined with regards to "how different national systems create diversity, reproduce routines and select firms, products and routines" (p. 106). He points out that the reason why national systems of innovation can be seen as an evolutionary concept is because of the strategic role given to learning and knowledge. Furthermore, it is useful to focus on the interplay of production structure, technology and institutions.

Balzat and Hanusch (2004) posit that in a national innovation system there are interactions between various organizations and agencies and these elements influence each other in order to carry out innovative activity. Thus, this whole system can be regarded as a subsystem of the national economy. Wang et. al

(2018) also conclude that the national system of innovation is composed of three segments, namely, universities, governments and businesses, each of them not only play their individual roles but also simultaneously interact with one another. Universities undertake scientific and technological research, educating the scientists and technologists who in turn are required by businesses and governments. Governments in turn design specialized systems for universities and businesses. Next, the businesses conduct R&D, commercialize products and processes. Henceforth, in their study they estimate that these elements form a conglomerate of independent interacting parties that together form the national innovation system and they have the potential to influence economic growth of a country.

Although the concept of national innovation system was strengthened by the popularity of Porter's (1990) theory on the 'comparative advantage of nations', the concept also faced a substantial amount of criticism. The approach was said to be too blurred and easily open to misunderstanding. In addition, it was 'too broad' and most importantly it missed the main idea to explain how innovation actually came about (Wang et.al 2018). Furthermore, earlier studies on national innovation systems did not follow a systematic approach and their main focus was on one country at a time. This quickly led to a development of several concepts. Now, there are various branches to the systematic approach to innovation.

Namely these are, the concept of technological systems by Carlsson and Stankiewicz (1991), the sectoral systems of innovations by Breschi and Malerba (1997) and the regional systems of innovation by Braczyk et.al (1998) and Ohmae (1993). All of these approaches observed not only how these systems improve the development and dissemination of innovation but also measured how successful these systems are in doing so (Wang et.al 2018). To conclude, the concept of national systems of innovation was introduced as mentioned above to help policy makers around the world to develop measures for technology policies, the objective being to enhance the management of innovation process at the national level. However, this concept has been widely and increasingly used by international organizations and institutions as an analytical framework to study technological change (Balzat and Hanusch 2004).

2.2 National Innovative Capacity

Numerous theories regarding national innovation systems have become noticeably broader and more diverse. Earlier studies focused on nation specific innovation patterns where the main interest spurred around heterogenous aspects across the system. Presently, a conversion of two streams of literature can be seen because of the shift in focus given to the performance comparisons across systems. On one side there is the formalized approach of innovation processes in which the locus revolves around country specific elements (Balzat and Hanusch 2004). Furman et. al (2002) first introduced the concept of "national innovative capacity" (NIC), which is a good example of this type of approach.

The national innovative capacity framework gathers from three areas of previous research; namely the ideas-driven growth theory (Romer, 1990), the cluster-based theory of national industrial competitive advantage (Porter, 1990) and the prior research on national innovation system (Nelson, 1993). The framework on national innovative capacity is a result of these three blocks of theories. National innovative capacity can be defined as "the ability of a country- as both a political and economic entity- to produce and commercialize a flow of new-to-the world technologies over the long term" (Furman et. al 2002, p. 900). This capacity is a reflection not only of the level of innovation but also of the primary conditions, investments and policy choices which manifest the environment for innovation in a country or particular location (Porter and Stern 2011).

The framework presented by Furman et. al (2002) on the national innovative capacity intends to determine which factors enable a region to innovate in the global arena. Three broad elements namely, common innovation infrastructure, cluster specific conditions and the quality of linkages capture the way in which a location embodies the ability of firms in specific areas to innovate at an international front.

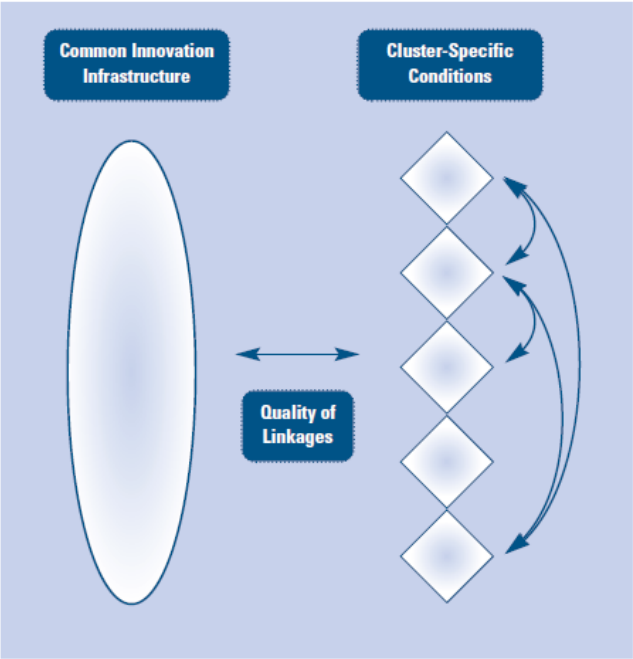

Figure. 1 National Innovative Capacity framework (Adapted from Porter and Stern 2011)

According to Furman et.al (2002), these three theories share similar analytical elements, however, vary only with regards to degree of absorption and factors they highlight.

Common Innovation Infrastructure

This aspect is based on the growth theory (Romer 1990). The focus is on a country wide "knowledge stock" i.e. there is a high degree of dependence on the availability of strong common innovation infrastructure; some factors that link and are partly responsible for innovativeness within and throughout an economy. It includes the total human and financial resources provided for technology advancement, overall innovation activity on the policy environment and the level of technology sophistication of the economy. Furthermore, the contribution of scientists and engineers to innovation lays the groundwork for the economy. Excellence in fundamental research and consequent advances powered by government funding is a necessary measure in addition to a strong policy infrastructure. Therefore, all in all, for a resilient and strong common infrastructure, there is a need for an array of national investments and policy choices (Porter and Stern 2011).

Cluster Specific Conditions

This aspect highlights the microeconomic foundation of innovation in national industrial clusters i.e. the innovative capability of a country is directly proportional to the specific innovation environment present in the industrial conglomeration of a country. Porter (1990) observes that the microeconomic environment in which firms compete is a strong stimulator for firms to contest with each other on the basis on new innovations. Several notable researchers have stressed on the importance of recognizing the dynamics of innovation within these conglomerates, particularly the interaction between clusters and institutions within geographic areas. "Innovation and the commercialization of new technologies takes place disproportionately in clusters – geographic concentrations of interconnected companies and institutions in a particular field" (Porter and Stern 2011, p. 6). They presented the cluster specific environment in a "diamond framework" which has the following four attributes- "the presence of high quality and specialized inputs, a context that encourages investment coupled with intense local rivalry, pressure and insight gleaned from sophisticated local demand, and the local presence of related and supporting industries" (p. 6). Clusters portray the different paramount facades of innovation that are within a particular geographic area. However, this environment varies in different fields and therefore, the global competitiveness of a cluster relies on its innovation orientation.

Quality of Linkages

This aspect accentuates the role of the national policy environment of a country, higher education and country-specific organizations and institutions. In other words, the relationship between common innovation infrastructure and clusters in an economy is complementary. This theory approach targets organizations and analyses their activity pattern that results in innovative behavior in the country in addition to identifying institutions and characters that play an influential part in certain industries and highlight the differences in national innovation approach (Nelson, 1993). The strength of the linkages between the common infrastructure and industry conglomerates of a country determine the national innovative capacity of that country (Furman et. al, 2002) as well as the global competitiveness level.

According to Balzat and Hanusch (2004), the national innovation capacity model serves as a "bridge between the elements of economic growth theory and a modern, systematic approach to innovation" (p. 202).

As opposed to the systematic approach of innovation processes, the other stream of literature aims to obtain clear cut advice for national policy makers. There has been a stark increase in the number of policy-oriented studies on innovation systems. This has by default led to building of innovation frameworks for policymakers around the world, specifically in highly industrialized countries. The outcomes gained so far in the studies are seen as a means to derive technological policy implications by the policymakers. In turn, the leanings from own and other country experiences provides an additional source of knowledge to the innovation design policy. Political interests and agreements have paved the way for implementing national benchmarking studies in addition to exploiting the terminology of innovation systems (Balzat and Hanusch 2004).

Aside from the political background, another main driver for comparative studies on national innovation systems is the research objectives in the economics of innovation literature. Keeping the discussed limitations of the national innovation systems in mind, prompt efforts have been made to carry out system level comparisons which have led to the initiation of the descriptive frameworks and analytical models. Liu and White (2001) introduced a conceptual framework that builds on five activities of innovation process. These activities are research, production, "end use (customers of the product or process outputs)", "linkage" and "education" (p. 1094). This model is different from the other acknowledged actor specific view of innovation systems.

2.3 Open Innovation

The current literature style has been talking of something called as open innovation. In economics, competitive markets that are imbalanced comprise of inflexible production components and uneven adjustability. But, the recent progress in the 21st century, like the depreciation in information development and transportation costs, unification of local markets into an international one along with the dissolution of boundaries between markets and countries has propelled the shift of the global economy from a closed to an open system. According to Chang and Chen (2015), globalization and international regional integration has been a stimulus for the changes seen in the quality and appearance of the national innovation systems research. Now, one of the main indicators for determining the innovation system of each country is the degree of openness of a country and global intercommunication. The result is that governments face the new challenge of how to respond to the new trend, strengthen the multilateral talks and links keeping in mind the current economic situations worldwide. Thus, new thoughts on "open innovation" are emerging from the previous "closed innovation" paradigm.

Numerous scholars have acknowledged the research done so far on open innovation (Martinez et. al 2008; Gassmann et. al 2010; Lichtenthaler 2011). However, Chang and Chen (2015) note that there is still a considerable lack of research study on the national innovation system. In their opinion, the current national innovation system needs to be improved and reformed by innovation players on the global network. Additionally, they hold the view that the national innovation system is an effective tool for government policymakers to evaluate complex circumstances although previous studies lack conformity and distinct structural models-theoretical and empirical, particularly the latter, on the open system of national innovation.

According to Chesbrough (2005), through knowledge promulgation (both influx and outflow), the main objective is to bolster the fortification of internal innovation and the diffusion to external markets. One of the main elements of the so-called open innovation is the significance of "knowledge flows and technological co-operation in order to break through the previous boundaries, make use of the inflows and outflows of knowledge and resources in a planned manner, and combine them with core competencies to accelerate innovation activities" (Chang and Chen 2015, p. 184). A few research studies decipher open innovation from the viewpoint of business strategies and that the concept also hints at the inclusion of organizational boundaries and absorptive capabilities.

Furthermore, open innovation is also considered as an embodiment of the innovation process (Trott 2008), wherein the connection of knowledge inputs leads to knowledge outputs. In a similar observation, Gassmann and Enkel (2004) suggest that there are three core processes in open innovation, namely, acquiring outside knowledge, conveying inside knowledge and the collaboration between these two. At the national level, the use of the open innovation paradigm to the national innovation system stresses on the build-up, incorporation and expansion of resources and knowledge in innovation. Therefore, it is essential that the model for innovation be conformed to open approaches in order to take in exterior ideas and create new value (Chang and Chen 2015).

Mechanism of Cumulativeness Conditions

Malerba and Orsenigo (1993) posit that there is always an accrual of knowledge from the previous innovation activities. Likewise, various scholars (Breschi et. al 2000; Peneder 2010) consider that the cumulativeness of advanced technologies as well as the knowledge reserve is pivotal to the building of a resilient science and technology system and that the creation of new knowledge from the previous stock will lead to a strong competitiveness as well. Chang

and Chen (2015) define cumulativeness conditions as "the mechanisms for knowledge accumulation in the open innovation system, which is mainly from accumulation of innovation resources such as human capital and R&D investments" (p. 186). This approach is in a way similar to the growth theory by Romer (1990) where innovation is derived from "knowledge stocks". Therefore, cumulativeness conditions can be considered as reserves for the past and present open innovation activities.

Mechanism of Diffusion Capabilities

In successful industrial clusters, there is a wide availability of knowledge diffusion in a documented and formalized way. This standardization mechanism has become an authenticated and important way of converting knowledge and intellectual capital. In 2007, in a survey conducted by Finland, it can be seen that the creation of know-how networks results in the open innovation of a system which reinforces the technology transfer and diffusion thus incrementing knowledge flux to foster innovation. Thus, information and communication technologies (ICT) along with technological and intellectual knowhow play pivotal roles in an open innovation system. Kayal (2008) emphasizes on the role of ICT infrastructure since it is one of the imperative elements to make sure there is constant advancement in the national innovative capacity and Zeng et. al (2010) consider the information and communication technology as a sub-system of the innovation infrastructure and innovation media that contributes to repeated enhancement. Therefore, innovation diffusion is the "diffusion mechanism of an open national innovation system, which, particularly with regard to information and communication technology dissemination and ICT infrastructure, determines the qualities of diffusion and operation of innovation process" (Chang and Chen 2015, p. 187).

Mechanism of International Linkages

International linkages can be defined as "the international linking mechanism of innovation activities, mainly determined by transnational investments, technological cooperation and personnel movements" (Chang and Chen 2015, p. 187). Some authors believe that the traditional national innovation system has been revolutionized into one that is extending and operating across national boundaries in part each due to global activities of multinationals and globalization respectively. This nature of open national innovation system is also believed to be one of the key characteristics.

Keeping in mind the aforementioned literature on national innovation systems, the underlying characteristics of it is to observe the interactions between various organizations and institutions and their interdependencies that bring out the innovation activities. This concept of traditional national innovation system has a focus on determining the relation between individual elements and sub-system with a viewpoint of the system. It results in a meager interaction between the system and the environment. Henceforth, with the recent trend in global and multilateral linkages, the open innovation concept is not limited to geographic and physical boundaries (Chang and Chen 2015). They also believe that global interaction and interdependence between countries will allow for the knowledge transfers and development of the open innovation system.

2.4 Innovative Capability and Absorptive Capability

The attention devoted to the national innovation systems has mainly been in examining the differences in cross-country technological capabilities as opposed to the dynamics of the innovation process. The national innovation systems are the main stimulants for competitiveness and economic growth. The studies on national innovation systems have focused on both the evolution and dynamics of national systems. However, there is yet to be a consistent and in-depth analysis of the factors that propel the dynamics of national systems. In this regard, the Schumpeterian literature does provide insights for building a stronger analytical framework to study the dynamics (Castellacci and Natera 2013) along with the growth theory that highlights the importance of the national innovative capacity for the growth of the economic system (Romer 1990; Furman et. al 2002) and the technology-gap models proposed by distinguished scholars (Abramovitz 1986, Verspagen 1991, Godinho et. al 2006, Fagerberg and Srholec 2008, Lee and Kim 2009).

The concept of innovative capability can be seen to have its origins from the growth theory (Romer 1990). The country's "knowledge stock" and innovations relies on factors like the size of the research sector and its productivity. Consequently, this determines the magnitude of innovative investments and inputs resulting in innovative outputs and economic performance. The model has influenced the growth of various idea-based growth models. On the other hand, the research studies have also looked upon the process of international knowledge dissemination and examined the causes by which national systems are developing, evolving and recouping on the technological front via learning and simulation activities.

Eminent scholars like Landes, Gerschenkron and Abramovitz researched historical studies of technological catch up and concluded that the process of international knowledge dissemination is a complex and demanding one. They further reviewed the causes and factors necessary for simulation based technological development. These factors determine the absorptive capacity of a country. Absorptive capacity can be both techno-economical, such as, "resource availabilities, factor supplies, technological capabilities, market scales and consumer demands", as well as socio-institutional like the "countries' level of education and technical competence, commercial, industrial and financial institutions that bear on their abilities to finance and operate modern, large-scale business and political and social characteristics that influence risks, incentives and personal rewards of economic activity" (Abramovitz 1994, p. 24).

Although most of the literature has ardently focused on innovation and growth, according to Castellacci and Natera (2013), there are two substantial subject concerns that have been overlooked. One of them is that there is a need to examine and analyze the drivers of national innovation activities in addition to the impacts of innovation on economic growth that have already been studied in great detail. Secondly, it is high time to conduct a time series analysis of the process of technological change and economic enhancement rather than carrying out cross-country comparisons. Therefore, in their study they put forth the idea that innovative capability and absorptive capability are connected in a bilateral dynamic relationship and that this process of co-evolution depicts a vital mechanism compelling the surge of national systems in the long term. Furthermore, these dimensions- innovative capability and absorptive capability-each consist of a set of factors and together both these dimensions evolve together along with the growth in income per capita.

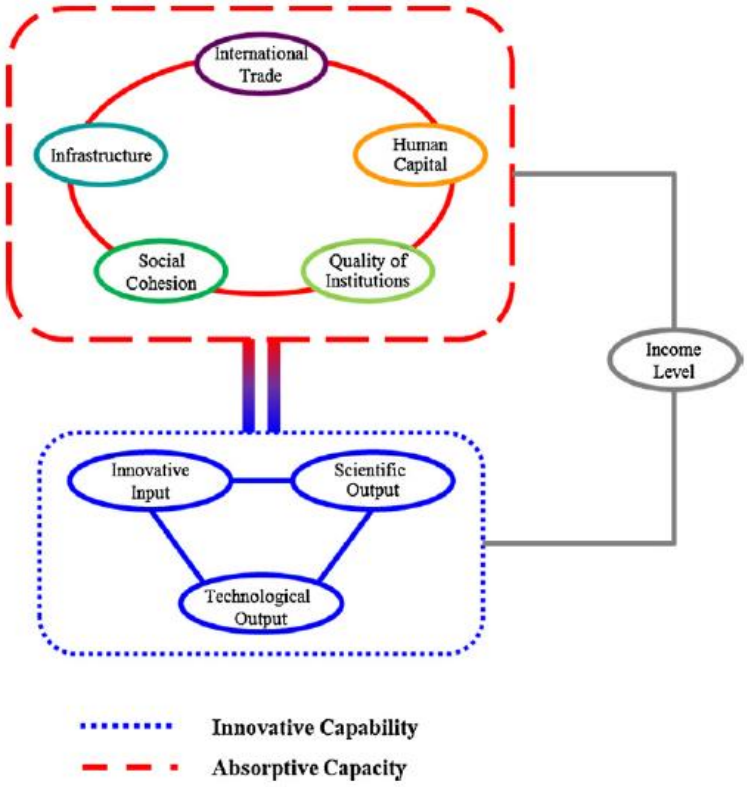

Figure 2: The coevolution of innovative and absorptive capability (Adapted from Castellacci and Natera (2013)).

2.5 Synthesis and Own Framework for the study

Kondratieff (1984) proposed that the evolution of capitalism happens through long waves (around 50-60 years). With each wave, there is a band of technological innovations which leads to new products, industries and infrastructure. Currently, this is the "information and telecommunications" wave which will be a driver for global economic growth in the next 20 to 30 years. The rapid diffusion of information and communication technologies in the economic system is seen to be more pronounced from the globalization era of 1990s. These technologies trigger and manifest more technological developments and encourage extensive innovations that affect innovative behavior, restructuring of the economy and improve productivity performance in all sectors of the modern economy (Pradhan et. al, 2015).

In an era of globalization, competition and the importance of knowledge as an economy driver, organizations and governments of all countries need to understand the role of ICT in enhancing competitiveness. Shea and Lewis

(2007) illustrate that collaboration and knowledge sharing by country strategists and organizational managers is imperative for obtaining high performance levels. ICT infrastructure in a country plays a significant role in the configuration of resources and strengthening of dynamic capabilities, aspiring towards the attainment of higher levels of competitiveness at national and international levels.

In an array of literature, it has been discussed that the impact of ICTs is creating incremental economic growth by the way of technological developments and innovation. Scholars suggest that a key instrument to cope with unknown externalities is by introducing new products, services, processes and business models through innovation.

In strategic management literature, the underlying approach of the resource-based theory (Barney 1991) of a firm is to see the firm as a unique bundle of tangible (e.g. financial assets, technology) and intangible resources (e.g. managerial skills, reputation) that are heterogeneous in nature (Wenerfelt 1984). It is imperative to understand the internal strengths of the firm and how these are obtained and developed from the factor markets. These resources can be a source of sustained competitive advantage provided they are not perfectly mobile, difficult to imitate, and non-substitutable (Manal et. al, 2012).

The dynamic capabilities framework by Teece et. al (1997), emerged as a spinoff of the resource-based theory and addresses the shortcomings of the same. In high technology industries like semiconductor, information services etc. there was a need to understand how to achieve competitive advantage to be globally competitive. In this regard, many companies like IBM and Philips followed the resources-based strategy. However, it was realized that this approach was not enough to sustain competitive advantage. In the global arena for firms to succeed, it was essential that they exhibit timely responsiveness, fast and flexible product innovation along with the management capability to integrate and reconfigure internal and external competences. This ability to achieve new levels of advantage was referred to as ‘dynamic capabilities’ (Teece et. al, 1997).

Resources can not only be assets, but also capabilities and knowledge. Therefore, ICT is regarded as a capability and the availability and effective use of this capability can help organizations and nations to achieve and sustain competitive and comparative superiority and advantage (Manal et. al, 2012). Countries differ in resource inheritance and intensity with which these resources are made use of. The disparity among economies in their ability to innovate is an empirical puzzle. Even though there is a general agreement that

technological innovation portrays a vital role in the long-term economic growth, there is still a question regarding the underlying drivers. This affects the performance of companies in that industry and country. Therefore, it is prudent to understand which country level characteristics drive the firm's financial performance and in turn the economic performance of the country.

The latest extensions in the national innovation systems concept is centered on global comparisons. Terms like 'innovation performance' or 'innovation efficiency' have been repeatedly used to describe the functioning of the system. Distinctive frameworks have been proposed to seek attention of the functioning of the system in most empirical works. However, most of the empirical research has failed to take into consideration the time series element and thereby the analysis of the dynamics of technological progress and economic growth over time. It is imperative to adopt a multifaceted account and quantification of the various factors that embody the absorptive capacity of countries. In addition, it is also necessary to probe the dynamics and evolution of absorptive capacity rather than viewing it as an external factor in cross-country comparisons.

From the literature reviewed so far, it can also be seen that Furman et. al (2002) presented an integrated framework of a national innovation system in which the concept of national innovative capacity was first introduced. Porter and Stern (2011) believe that the international competitiveness is reliant on innovation as innovation can improve productivity, consumer value and the prosperity in all nations. Thus, innovation is one of the key factors that propels national innovative capacity. The three main categories of division of innovation factors are 1) common innovation infrastructure, 2) cluster specific conditions in particular groups of interrelated industries, and 3) the quality and strength of linkages between them. This innovation capability is the ability to create and build new technologies by alterations and modifications of the existing ones (Furman et. al 2002).

Along with the innovation capability, there is also a need to understand the absorptive capability and its dynamics. For absorptive capacity, it is crucial to understand and examine the factors required for imitation based technological development. The theoretical models presented in the technology-gap studies have often looked at human capital as the main cause of shaping the country's capability to simulate and absorb outside advanced technology. Whereas on the other hand, the empirical works rely more on the growth-regression approach and illustrate the other factors that are both techno-economic and socio-institutional in nature (Castellacci and Natera 2013).

The model for an open national innovation system needs to include both the diffusion capabilities and international relations. The linkage is regarded as the flow of knowledge between different elements in the paradigm of open innovation rather than just an orientation of a single knowledge production. Considering all the possible approaches, frameworks and own perspectives, the following visual synopsis is used in this study.

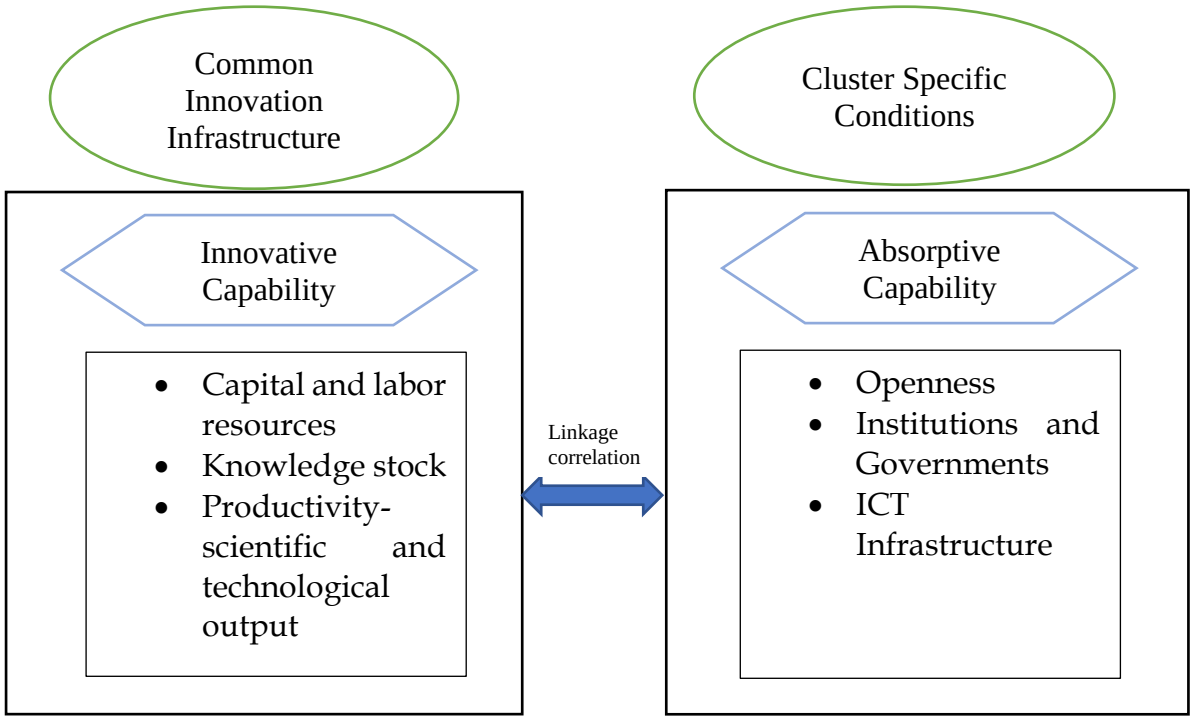

Figure 3: Framework of national innovation system (Own interpretation based on Furman et. al 2002; Castellacci and Natera 2013).

Innovative capability depends in part on the common innovation infrastructure. Additionally, the factors like capital and labor, knowledge stock and productivity results from innovation activities carried out by public scientific and technical publications and private firms provide and create the necessary thrust for innovation capability. On the other hand, the absorptive capability in part is related to the development and commercialization of new technologies created in an environmental cluster. The key factors that drive this capability is the openness of the national system to be able to simulate external knowledge, the interrelationships between the institution and government systems and most importantly the presence of infrastructure in information and communications technology has been additionally included in this framework taking in consideration the current advancement and trends globally.

Consequently, the absorptive capacity also determines the competitiveness of an economy in an international arena. The co-evolution between these two-dimensional capabilities also plays an important role in the long run dynamics of a country.

3 DATA AND RESEARCH METHOD

3.1 Research Background

3.1.1 Innovation policies

The term "innovation policy" gained in popularity around the 1990s when international organizations like the OECD became more open to the term and later adopted it. During this time, a relatively fresh approach to the study of innovation was surfacing as well (Edquist 2004; Lundvall 2007). Since, the term was made of use in many a different way, different uses of the term lead to different perceptions. Although the term has been frequented some decades ago, "innovation as a phenomenon is as old as mankind itself" (Edler and Fagerberg 2017, p.3). Prior to the term being coined, it was referred to as the "science policy" during the 1960s and that later changed to the "technology policy" (Fagerberg 2015). It can also be said that innovation activities shaped quite a number of policies that may have been labelled under different titles. The figure below shows the frequency of the usage of terms according to Google.

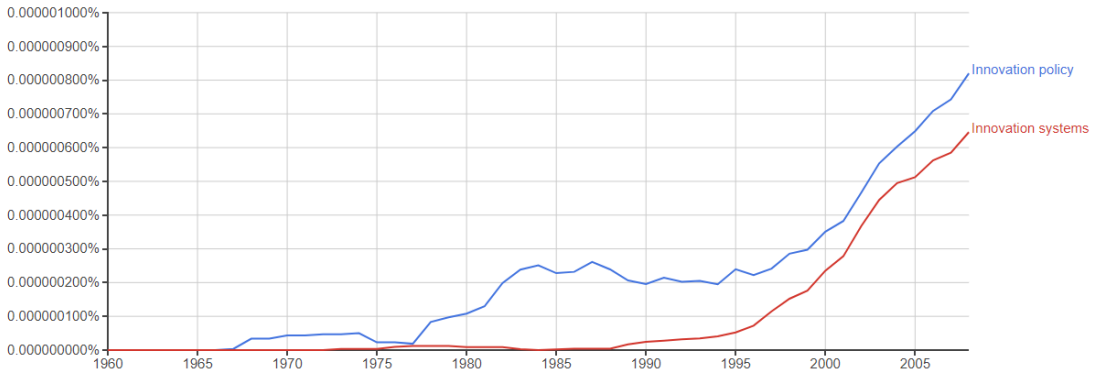

Figure 4: The frequency and use of the term "innovation policy" and "innovation systems" from 1960s to 2008. Source- https://books.google.com/ngrams . Accessed 26th September 2018.

In summation, Edquist (2002) defined innovation policy as "a public action that influences technical change and other kinds of innovation" (p.2). Additionally, he further noted that "innovation policy includes elements of R&D policy, technological policy, infrastructure policy and education policy" (p.2).

3.1.2 Different types of Innovation policies

Various policies and policy instruments were initiated at separate points in time using different labels directed towards innovation and its activities (Lundvall and Borras 2004; Boekholt 2010). In the 1980s, Kline and Rosenberg (1986) felt that it is not enough to merely focus on the occurrence of innovation in order to boost the economic and social system, there is a need to also thoroughly grasp and understand the adoption and successive exploitation of the process. Therefore, from their perspective, innovation polices needed to focus on the genesis of new ideas and development along with their subsequent exploitation and diffusion. This should also encompass a feedback loop between the different phases of the innovation process.

Based on the diverse thoughts addressed previously, innovation polices were categorized into three main types (Edler and Fagerberg 2017):

Mission Oriented Policies

These polices were made with the objective of development of new ideas, solutions and practices to specific challenges on the political agenda. This type involves designing and implementing policies using a broad approach by the policy makers. Almost all governments tend to make use of this policy for example in defense purposes and more recently to incorporate the impact of the age of the internet and global warming issues.

Invention Oriented Policies

These policies have a narrow focus and are concentrated mainly on the R&D or invention phase of the process and allow the market to take charge of the diffusion and exploitation process. These policies have initiated the creation of new public organizations like the technical research councils that support companies and research organizations.

System oriented policies

These are the most recent type of policies developed. Their main function, as the name suggests, is on system level features and characteristics like coordinating the degree of interaction between the components of the system, taking care of the capabilities of the actors and the components that take part in the system. The emergence of the "national innovation systems" approach is related to the development of system level policies.

3.1.3 Interlinking of NIS and Innovation policies

The period after the Second World War saw a tremendous increase in productivity, income and employment level in the Western countries. However, successively the decades that followed were more grueling and required fresh viewpoints on policies. Scholars and decision makers began to pay attention to the role played by technological innovation in improving the long-term economic growth (Romer 1990; OECD 1992).

These key players, specially policy makers, were far more interested in how policies can contribute to enhancing the innovative activity and reviving the economy. The NIS approach provided a new form of framework to the policy makers to face the upcoming challenges. The national innovation systems are not only frameworks for interaction but are also storehouses of various resources. Research has shown that there are different factors that influence innovation such as skills and capabilities, knowledge, financing options and demand and these are inherent to the nation. Consequently, if there is no provision for such factors there is likely to be a chance off system failure resulting in hampering innovation.

Policy makers play a decisive role in order to aid and assist in the diffusion of innovations and revival of capabilities among firms if they are able to undertake and bring to agreement the aim and objectives of the stakeholders towards development and dissipation of innovation. Furthermore, they need to "define the main national objectives and implement several policy programs that address the diversity of national players with different objectives, in order to strengthen the impact of governmental measures" (Bodas Freitas and von Tunzelmann 2008, p. 1447).

In essence, the current global complexity of national systems of innovation policy making requires a suitable coordination and fit between policy design and its objectives (McGowan et. al 2004). The government must not feel the need to curb to provide funds for basic research and knowledge, help in exercising IPRs and rectify systemic issues (Metcalfe 1994,1995). Therefore, innovation policies need to comprise of structures that are distinct practically (technology, production, finance, management etc.) in terms of resources (labor, capital, natural) and dimensionally (regional, national, supranational levels) (McGowan et. al 2004).

3.2 Research Methodology

The main objective of this study was to get a comparative understanding of the connection between innovation activities, economic performance and information and communication infrastructure between Finland (the developed economy context) and India (the developing economy context). Since the comparison is on a national level, it is important to primarily grasp the development of the national innovation systems and then further move onto analyzing the innovation policies of both these countries for a period from 2002 until 2017.

Innovation systems need to undergo change to not only keep up with the changing environment but also need to incorporate the major changes into the system through adoption and diffusion. However, this can only happen when the state acknowledges and acts on the changes in the form of polices that escalate the innovation environment of the residing institutions and organizations in order for them to help in strengthening and reinforcing the national economic performance.

For a national level comparative analysis, a key constraint was the availability of primary data for both countries in the study which could have been in the form of interviews (for example government officials or key stakeholders), observation or letters and other types of correspondence. Therefore, secondary data was solely relied upon for performing this research study. Secondary data is based on published data or in other words usage of existing data by researchers who were not part of the original data collection process (Greenhoot and Dowsett 2012).

Data was gathered through a web-based approach and more specifically adhered to introduction of innovation policies by the respective governments, changes in the policies that took place in the field of information technology, education, technology and research and the collective actions by the governments in the stated time period. Additionally, the qualitative methodology was ideally more suited for this research study. It focused on showcasing the evolution of the national level approaches, the operation of the respective systems and changes taking place in both countries over a period of time.

3.3 Data Collection

Secondary data was the primary form of data used of in this study. In particular, in the case of Finland, publicly available data was collected from the Ministry of Economic Affairs and Employment as well as from the Finnish Innovation Fund, Sitra. In the case of India, data was collected from the Department of Science and Technology and the National Planning Commission and the National Institution for Transforming India (NITI Aayog).

In both countries, a study of the research reports, statistics, web pages, official government publications and descriptive articles about evolution of innovation systems, current scenarios and their evaluations was conducted. In case of statistical information, the latest figures available from OECD, World Bank and World Economic Forum were taken to rule out any unreliability issues.

For Finland, 22 research reports and descriptive articles were collected and later analyzed. Out of these a total of 13 reports and articles related to policy changes undertaken by the government. The remaining 9 consisted of descriptive articles that were used in complementing text in the analysis section. In the case of India 16 such reports and articles were collected and analyzed. Out of these 13 reports and articles comprised of the government national policies and directives. The remaining 3 were descriptive articles used for complementing the analysis section. A detailed table of the name of the reports, publisher name and number of pages can be found in Appendix 1. These articles and reports were collected in the months of July and August. The analysis of the articles took almost a whole month to carry out.

After analyzing the data for both these countries patterns were detected. These were more or less the central elements and the focus points of the government changes in both these countries.

3.4 Method of Analysis

The research method made use of in this study was a qualitative descriptive method in the form of content analysis. In this study innovation polices in Finland and India were investigated from a period of 2002 until 2017 for both countries.

Content analysis has been used widely in qualitative research to analyze text data. This research focuses on the content, as the name suggests, and contextual

meaning of the text. Furthermore, the text in the data can be verbal, print or in electronic form and can be retrieved from interviews, articles, observations, books, manuals etc. (Hsieh and Shannon 2005; Lindkvist 1981; Tesch 1990; Kondracki and Wellmann 2002). Weber (1990) postulated that in qualitative content analysis the idea is to make use of the large quantity of text into particular categories and distinct areas that represent similar meaning. Ultimately, the goal is "to provide knowledge and understanding of the phenomenon in the study" (Downe- Wamboldt 1992, p. 314). This study makes use of this method to interpret the text subjectively by identifying patterns and themes in the analyzed data.

4 DATA FINDINGS

4.1 General Information

This section presents the data from analyzing the policies related to the national systems of innovation for Finland and India. These two countries have been chosen for comparison because they provide a good contrast of the evolution of and approaches used for innovation systems on a national level. Finland is regularly ranked high in technology and innovation capabilities in international comparisons, whereas India tends not to do so well.

Government policies can be regarded as the key component that links innovation and absorption capabilities in order for an innovation system (refer to Figure 3) to operate in a country. Subsequently, from the figure it can be seen that for the government policies to be effective the respective elements need to be strategically utilized. Using the content analysis for analyzing the policies, government reports and articles for each of these countries, five particular categories were derived and are therefore used in this study hereafter. In almost all of the data analyzed from both countries, the action steps (past, present and future) taken by the government revolved around these categories. For each of the respective countries, they were termed under the headings: *Growth environment, Collaboration environment, Availability of resources, Openness of the region and Government outlook*. The growth environment for the country relates to, as the name suggests, the current atmosphere of growth in the country (both the positive and negative side factors), the government targets in the various science, technology and innovation sectors and the overall competitiveness. The collaboration environment highlights the industry-university-institute relationship in the country along with the contributions from researchers, students and professors and their social capital in the form of connections, networks and ties.

The availability of resources category refers to the ease of access to financing capital, labor and intellectual property management and technology transfer. This category also includes the risk-taking capabilities of the industries as well as its ability internationalize. The fourth category, openness of the region, stresses on the importance of foreign and global talents, how well they are integrated into society irrespective of their country and backgrounds and how easily the industry is able to draw diverse international talent. It also includes the size, scale and regional dimension of the domestic market. The final category, government outlook, relates to approach (centralized or decentralized) taken by the political and government authorities, the private sector involvement in the policy and decision-making process and whether the

government ministries operate in individual vertical silos or encourage cross linking between ministries.

The time frame selected for this study gives it a certain dynamic aspect which is in consonance with the fact that innovation systems change over time (Hart 2009). The findings in this study support this fact as well. As mentioned earlier, government policies have more recently been operating on system levels and thus they need to take into consideration the interaction between its components. The derived categories depict these system level components contextually to help in understanding the national level policies in each of these countries. In the further sections, the innovation systems of Finland and India are described in detail. Furthermore, the articles found from government portals and databases have been coded and attached in Appendix 1. Opinions given in the findings reflect from the data and are also used as direct quotations in some parts, referenced with their respective codes.

4.2 Innovation System in Finland

4.2.1 Background

In a relatively short period of time, Finland has managed to be one of the leading countries in the knowledge economy. It has persistently been among the top performers in the international competitiveness rankings. In the recent reports released by the World Economic Forum (2017) and the Global Innovation Index (2018), it ranked in the top 10. The country has come a long way from being a laggard to one of the leading developed countries post the Second World War.

This feat is noteworthy keeping in mind its economic situation in the 90s. The forest industry was the engine for its economic growth until this time. In the 1990s, the country suffered a severe economic recession. Unregulated financial markets and oversized foreign borrowing led to high inflation, high interest rates, rise in unemployment and welfare costs. Additionally, with the fall of the Soviet Union it was pushed into further recession because that was a major market for Finnish exports due to the proximity. Furthermore, it was not well prepared for its integration into the European Union and the European Monetary Union due to the lack of diversity in its export market (Dahlman et. al 2006).

From then on, there has been "a deliberate economic transformation from the dominance of the forest industry to a knowledge society" (Woiceshyn and Eriksson 2014, p. 22). In order to join the common market, the Finnish government gave up non-compliant macroeconomic interventions like currency devaluations that protected the forest industry. Microeconomic measures and long term economic focused policies that were in alignment with the EU regulations were instead put into use. These major changes came in effect even before the breakthrough of Nokia and other ICT companies. This ultimately led to the diversification of exports which greatly improved the performance of the economy.

The innovation policy has been the key factor in all its programs so far. The actors in the Finnish Innovation system generally comprise of:

a) Research and Innovation Council: It is chaired by the prime minister and advices the government and ministries on important matters that concern research, technology and innovation; their usage and evaluation. This is the main body that is accountable for the coordination of the science and technology policy as well as the innovation system as a whole. It was previously known as the Science and Technology Policy Council.
b) The Ministry of Education and Culture: It looks after the policies that concern education, science, culture, sports, youth and their international collaboration.
c) The Ministry of Economy and Employment: The ministry is responsible for the overall operating environment concerning entrepreneurship and innovation activities, the labor market and the regional development within the economy.
d) Academy of Finland: This is a government funding body for basic research and functions within the administrative sector of the Ministry of Education and Culture.
e) Business Finland: This agency came into formation in 2018 with a merger between Tekes, the funding agency for technology and innovation, and Finnpro Oy, a company that offered services for internationalization and investments. With the merger, the new organization achieves both the objectives from a single platform.
f) Sitra: Known as the Finnish Innovation Fund, this independent public organization operates directly under the Finnish parliament and helps in promoting the welfare of the society.
g) Strategic Centers for Science, Technology and Innovation (SHOKs): These have recently been established in order to strengthen research and innovation.

4.2.2 Policy Governance and Steering

Growth Environment

From the turn of the millennium, Finland has been credited for its well operating institutions, innovation environment, emphasis placed on research and development, adherence to the traditional Nordic values which have been practiced till date, strengthening of its technological competence and being a stable and functioning economy. As a result, this has directly contributed to its economic success and its overall growth environment.

With the changes in the global technological advancement post 2002, a major shift in government policy measures was undertaken. With the breakthrough of Nokia and Finland's entry into the European Union, the government aimed at creating and facilitating an environment of networking and collaboration between the innovation system participants.

> "The state does not intend to 'pick a winner', but rather to create universal prerequisites for growth." (F1-1)

There was increased R&D spending both by the public and private sector in areas like food, forests, telecommunications, welfare and environment to assist in job creation and intensification of innovation practices. In 2008, the government introduced the new National Innovation Strategy because they felt that the system was good but not good enough to support the future challenges and contingencies. The strategy called for a broad based and systemic approach. In addition, the strategy's main objectives were to bring about an improvement in productivity and become a pioneer in innovation activity.

The period of introduction of the new national strategy coincided with the transformation of the whole public research system especially the reform of the university system. The Universities Act gave the universities economic and administrative autonomy without changing the main mission of education, research and regional interaction. With the help of this, universities would be able to respond flexibly and independently to the challenges that rise from their financial status. The most prominent example of this was the merging of Helsinki University of Technology, Helsinki School of Economics and University of Art and Design to form the new Aalto University.

The other structural change was the formation of Strategic Centers for Science, Technology and Innovation (SHOKs), to improve intensive research efforts targeted at six selected areas and produce new knowledge that can be

developed into new commercial outputs. The R&D institute system is primarily funded by the Academy of Finland for basic research, while Tekes on the other hand is a funding agency for innovative research and development projects in companies, universities and research institutes. Financing from Tekes and the Academy has consistently increased year on year compared to the direct government financing. However, a major concern is that funding for basic research is under financed in favor of applied research and short-term research projects.

Policy initiatives aimed at increasing the number of successful High Growth Entrepreneurial Firms in Finland were implemented with the new strategy. This was due to the fact that there were not enough growth firms in the country as compared to its competitors and entrepreneurs were too modest in their ambitions.

> "Innovation policy must be entrepreneurship policy - a key viewpoint to consider when reforming public services. In Finland, entrepreneurship activity has been found wanting, and its development calls for measures that also pay attention to the novel attitudes of new generations to entrepreneurship". (F1-6)

The 2008 strategy also stressed on the importance of creating demand and user orientation in Finland. The government felt that competitive strength can be achieved by realizing the needs and wants of the customers, consumers and citizens and so policies must create preconditions for development of user-oriented innovation environment.

The strategy brought about significant changes in the Finnish governance model in order to push the economy into attaining new heights of growth and economic success. Recently, with the formation of the new government in 2014, the action plan has moved towards making Finland a pioneer in the circular economy by 2025. With the circular economy model, the government is striving to maximize the circulation of products, material, components and their value within the economy with the long-term goal of sustainable development.

> "This mindset emphasizes the state's role in facilitating a progressive growth platform that is favorable for the domestic market and companies and, on the other hand, a strong company, export and technology orientation combined with the search for comprehensive solutions and co-operation covering the entire value chain". (F2-6)

In addition to boosting the circular economy, the new government has also undertaken various programs keeping a competence-based growth approach in mind. The objective is to bring the Finnish economy on a path of sustainable growth and increase employment with the help of digitalization. These programs focus on activating the unemployed, encouraging entrepreneurship, creating a sharing economy platform, consolidating communication networks and digitizing processes within public and private sector to increase efficiency.

Collaboration Environment

Finland like various other countries has set up various organizations and systems that facilitate the transfer of knowledge from universities and research institutions to companies. The ties between the industry and the universities have developed considerably over time. There is a high level of trust that is enhanced by the personal connections between various actors across different sectors.

The Finnish government ensured that the circular economy roadmap report was developed as an open book process with a variety of stakeholders and their opinions and considerations paid attention to. The overall governing body is Sitra.

> "The road map has been developed in an open process with broad stakeholder engagement. Policy measures, key projects and pilots have been created based on stakeholder consultations and working groups". (F2-6)

Based on evaluations of previous policy reports, the government is looking at creating various cooperation programs to strengthen the ties between the higher education sector and industry and organize training programs for businesses, academicians, students in data communications and network technologies to expediate knowledge transfer processes. Considerable efforts have been made to revive the innovation ecosystem through the regional centers of innovation.

Availability of resources

One of the main objectives of the 2008 strategy was to make use of the available resources, individuals and communities, to aid in innovation. The measures taken up by the government included enhancing the research capacity of universities and research institutes, creating regional innovation centers with

world class operating environment and renewing the legislature and architecture of the operating environment.

> "The specialization of regions in their strengths will increase their critical mass of expertise and improve their ability to link with expertise and value networks vital to their own development. Regionally decentralized research, development and innovation activity will become a national resource when pooled into networked innovation communities". (F1-6)

Evaluation of reports highlighted the fact that high taxes and inflexible labor markets were one of the main factors for weakening the Finnish economy in addition to a small domestic market and low competition levels. Furthermore, it was also observed that there is a tendency to stick to traditional tools of operations in the hope of getting different results.

> "The future of the country is less on a few leading industries and companies and more on widespread entrepreneurial activity". (F1-9)

> "Finland's structural challenges were present well before the ongoing financial crisis, which only heightens the sense of urgency in addressing them". (F1-9)

Scattered resources with overlapping duties, internal fragmentation of universities around the country and scarce knowledge about intellectual property rights were seen as main contributors to low research output volume and its quality.

The present government has carried forward the prior initiatives and previously suggested modifications in addition to supplementing some of their own keeping in mind the digital transformation in the world. The government has initiated process of creating national electronic identification system that can provide a possibility to steer the interoperability among all public sector information systems. Next the government is also automating the data flow between companies and public administration to increase the amount of up to date information and eliminate double work.

Another major step taken by the government is to integrate incentives for individuals and organizations into policy making and reform labor administration to support employment and lastly promote growth entrepreneurship.

> "The objective of the reform is to alleviate labor market mismatch problems, eliminate demotivating measures, harmonize the interpretation of regulations across the labor administration and focus labor administration resources on activation measures". (F1-13)

Openness of the region

Considering both regional and international dimension of openness is of prime importance even though an innovation policy is inherently national. In the various reports analyzed by international and national experts, it was observed that innovation intensity is highly concentrated regionally. The Helsinki sub-region serves as the primary headquarters for almost all of the firms. It also provides abundant diversity due to the presence of leading universities that play their part in attracting global talent.

Internationalization and international collaboration have been on the policy agenda since a long time in Finland. Despite this fact, evaluation reports and government documents cite that this dimension is still weak. With globalization, there has been an improvement in international trade and cross border direct investment. However, Finland still needs to improve on its networking skills.

> "The Finnish system is less international than conventionally thought and there are signs that it is falling further behind". (F2-8)

On different accounts, factors relating to the need for Finnish companies to improve their position in the international market were also pointed out. In order to influence the international market and its operating conditions there was a need to raise efficiency in activities that involved external economic relations. This would also provide a chance to enhance operating conditions of the knowledge intensive industries.

Another important criterion expressed by experts for openness is not only based on the ability to attract foreign talent but equally important is the ability of the residing natives to move abroad to experience new cultures, business practices, tapping into new knowledge and bringing it back. This criterion is valid not just for students but also for research faculty and professors.

Currently, with world class learning universities and institutes and maintained infrastructure, the government plans on promoting internationalization of higher education. For this it has taken steps to establish a Team Finland knowledge network. This is an effort made by the Ministry of Education and Culture to enhance Finnish education and research cooperation and the export of Finnish knowledge and expertise. The countries where the network will initially operate are China, Singapore, North America, Latin America, Sub-Saharan Africa, India and Russia.

An additional government program, Talent Boost, is a joint program to attract international talent to Finland and make use of their contacts and networks to accelerate investment and business growth.

> "The program measures will include targeted country branding, ensuring that the necessary services are in place, and developing business ecosystems, innovation platforms and the labor market so that they welcome international talents and encourage entrepreneurship". (F1-13)

Government Outlook

The 2008 national innovation strategy was considered to be a stepping stone for Finland. This was due to the fact that it called for a 'strategic renewal and structural development of the entire system' (F1-6). With its systemic approach the government had begun to implement its broad-based innovation polices in a two way (top down and bottom up) interactive manner. The creation of a sustainable circular economy and competence-based growth have stemmed from it despite having to resolve many hurdles along the way.

An international evaluation report distinctly highlighted that government ministries operate in a decentralized manner. However, the independence of the ministries is very pronounced which has led to formation of vertical silos.

> "Currently there is a tendency for each ministry to strongly defend its turf and to be somewhat absent minded with respect to the needs of others". (F1-9)

> "The lack of cross-ministerial decision making, and execution is evidenced by the repeatedly failed attempts to reform the sectoral research system (i.e., the system of public research organizations), even if the need for a reform is widely acknowledged and agreed on". (F1-9)

Attempts to break out of these silos have seen little success until the recent change in government. A main contributor to this inertia was the fact that clear goals were not articulated and no integration mechanisms within ministries was established to support the government's strategic priorities.

Another issue points out that private sector involvement in policy making or resolving key issues in Finland since the 2000s has been very much limited. More commonly, minsters from the various ministries and appointed permanent secretaries have been majorly involved in making national decisions and directives. In line with this it was also seen that despite the introduction of various national strategies, there was a lack of a unified government approach that works towards a common agenda.

> "The principal problem, in our view, is the lack of integration between various "capability- enhancing enablers", combined with the absence of certain "critical enablers". The new national foresight process does not provide much strategic sensitivity unless it is deeply integrated into the policymaking process, and ultimately into the government program of the country". (F2-4)

> "National, regional, and local actions and instruments are not considered jointly". (F1-9)

Since 2014, the new government has acknowledged these crucial issues and tried to address each one of them into its action plan. With the creation of a nationwide information platform, it aims to increase transparency and efficiency while keeping the current decentralized model. It has also created a shared administrative unit that will "direct, align, develop and provide shared administrative support services across the entire government" (F2-4). With this, it also aims to promote "shared culture and collective identity throughout the government" (F2-4).

To improve the crosslinking between the ministries it is trying to revive the original "Cabinet evening school" ideology, only this time it is a forum called the "quintet" where all parties in the coalition government meet with the PM. In order to improve private sector participation in the governance, various programs have been launched like the creation of the circular economy roadmap, the establishment of the ten-year research, development and innovation program, the ICT 2023, creating a culture of experimenting and reforming the central and regional administration. All of these programs have included industry experts from Finland and abroad and various ministers.

4.3 Innovation System in India

4.3.1 Background

Post-independence, a section of scientists, policy makers and industrialists saw the importance of large-scale industrialization and the role of S&T in the national development. Initially, not much was expected from the private sector and more emphasis was given to empower public sector undertakings. Industrial policy resolutions and S&T policies were formulated separately. The former emphasized state monopoly to all heavy industries, successive decentralization and later stressed the need to encourage domestic competition with technology upgradation. The S&T policies exclusively stressed on the cultivation of scientific research- basic, applied and educational. However, the overall direction and allocation of resources guides came from the Five-Year Plans (Dhar and Saha 2014; Gopalakrishnan and Dasgupta 2018).

The initial Five-Year Plans took to building national laboratories and research institutions, promoting broad based scientific research and establishing new technological universities. By the 1980s, realities had greatly changed and the achievements in gaining technological capabilities and gaining national competitiveness had gravely faltered. The second Science and Technology Policy introduced in 1983 "placed technological self-reliance at the heart of indigenous technological paradigm" (Dhar and Saha 2014, p. 16). It also included efficient absorption and diffusion of imported technology. Even though the industry encouraged building capabilities and reverse engineering, there were strict regulations for technology import with a narrow window for clearances.

Finally, in the 90s with the liberalization of economic regulations and protectionist policies, policy making in the S&T sector started aligning with the overall economic framework. The policy changes favored industrial R&D, identification of technology needs and technology development. With innovation activities garnering importance, they were incorporated into the policies and government plans from 2010. The three main actors involved in the S&T system that formulate research policies and play an advisory role for the long term are:

a) The National Institution for Transforming India (NITI Aayog): This body was previously known as the National Planning Commission under the previous government. It is the think tank of the Government of India and the Prime Minister serves as the Chair. Additionally, the members comprise of ministers from different government sectors and private sector experts.

b) Ministry of Science and Technology which also includes the Department of Science and Technology (DST): The Department controls and distributes R&D funds to all areas of research and science agencies.
c) The Principal Scientific Advisor, the Science Advisory Council to the Prime Minister.

The figure below represents a clearer picture of the governance model in India.

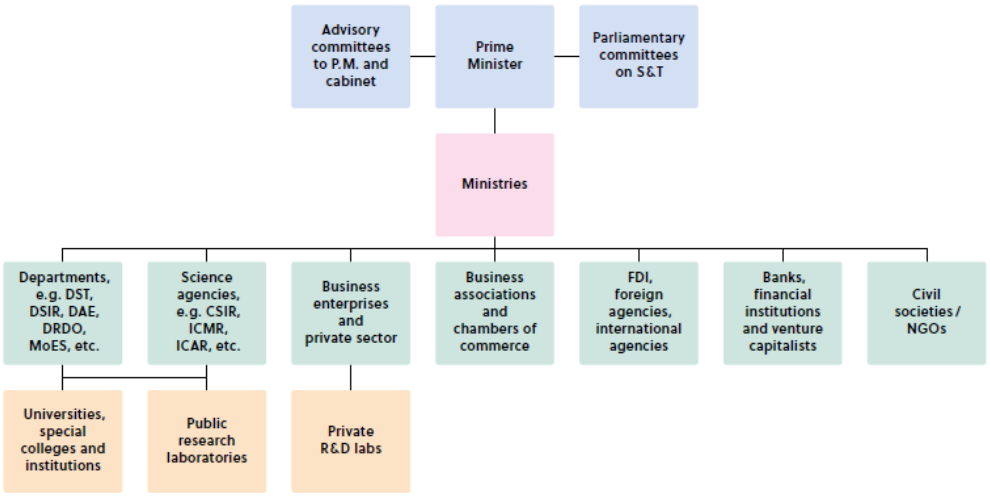

Figure 5: Overview of the research governance model. Adapted from Indigo Policy 2016.

Furthermore, the main research performers that contribute to the national innovation system in India consist of:

a) Public research system: These consist of national laboratories dedicated to space, atomic energy, industrial research etc. that fall under the science and technology agencies and R&D laboratories in large public sector enterprises. This is the main contributor to the innovation system.
b) Private business enterprises and transnational corporations (TNCs) (both Indian and foreign): This the second main player of the system and in the recent times has gained in importance. The TNC R&D centers are oriented towards creative technology for top level domestic and global markets.
c) Higher education institutions: This includes universities, institutes of technology, management and science.
d) NGOs and civil society organizations: This sector has started to undertake policy-oriented research in relation to science and technology matters. Additionally, it is involved in national decision making in diverse fields like environment, energy, microenterprises, women and gender and rural development.

4.3.2 Policy Governance and Steering

Growth environment

The economic emergence of the Indian economy is attributed to technological learning, science and technology in strategic centers and human resources in current knowledge intensive industrial sectors.

The S&T policy of 2003 brought about major changes in endorsing globalization and exports. In this phase, the country soared high in ICT software, automotive, pharmaceuticals and telecommunications. This policy further reinforced the sectors of atomic energy, defense and space research. It culminated in setting up R&D centers for 100 transnational corporations to take advantage of the high economic growth. Successively, the Eleventh Five-Year plan was introduced in 2008. The plan aimed for an inclusive growth which provided broad based benefits and an equal opportunity for everyone.

> "The central vision of the Eleventh Plan is to build on our strengths to trigger a development process which ensures broad-based improvement in the quality of life of the people". (I2-1)

The Twelfth Five-Year plan reiterated the vision of the previous one with the additional inclusion of the point that advocates for a greater role of the respective states and a close coordination between the center and states. This coordination would benefit the growth of the small and medium enterprises that lie within the state domain. This way the center would be only responsible for creating the macroeconomic framework, financial sector policies and national level infrastructure.

Coincidently, the science, technology and innovation policy of 2013 was introduced as well. This policy stressed on making innovation inclusive in the Indian STI enterprise. For the first time it was in this policy that innovation was acknowledged to be the driver for development.

> "India has declared 2010-20 as the "Decade of Innovation". The Government has stressed the need to enunciate a policy to synergize science, technology and innovation and has also established the National Innovation Council". (I1-5)

> "Science, technology and innovation for the people is the new paradigm of the Indian STI enterprise". (I1-5)

Over the years, India has significantly progressed in terms of setting up centers of excellence in science, technology and business education. These institutes have prospered and produced some of the world's brilliant minds. The competitive atmosphere and inflow of meritorious students have placed these institutes in the top spots.

> "India has been identified as one such innovation achiever in its peer group of lower-middle-income economies in the Central and Southern Asia region". (I1-7)

Evaluation reports have remarked that in India the implementation of solutions is very low at government levels due to the fact that systems and procedures are mostly process driven rather than being result oriented. Moreover, the demand and supply gap for higher education in India is enormous leaving a very large section of the population deprived of educational opportunities after high school. Furthermore, research intensity and funding is very low, and the contribution of the private sector has been minimal and confined to applied research.

Having opened the Information Technology and Telecom sectors to competition has brought in an enlarged revenue to the sector and to the economy. However, despite this fact, India has ranked poorly in areas like political stability, ease of doing business, tertiary inbound mobility and environmental performance in various global innovation indices.

> "These findings also resonate with the general public's perception that the government has been relatively inactive during this period in terms of making policy decisions". (I1-7)

With a new government in place since 2014, it has continued the previously successful programs, initiating new ones while paying close attention to any policy recommendations based on possible future scenarios. The government has laid special emphasis on its national flagship programs that entail S&T, R&D and technological inputs and resources and includes a multiple of sectors and heavy coordination within ministries. The programs are aimed at making India a manufacturing hub, fostering India's success in ICT software in ways like issuing unique identification cards based on digital biometric information, maintaining an open government platform, creation of data centers, enhancing skill development and entrepreneurship and focusing on renewable energy technologies.

> "Digital India is all about democratization of information at all levels with openness, accessibility, connectivity, networking and decentralization". (I1-4)

Collaboration Environment

Since the 90s, policies in the science and technology sector started to align with the overall economic policy. This shift in focus was mainly directed towards collaboration of public and private institutions, technology development and identifying technology needs. Despite the structural changes brought about in the new millennium, India still faced a lack of adequate university-industry partnerships or networks to access funds or management skills.

> "there is a need to ensure availability and access to adequate funding for technology entrepreneurs and commercialization of innovation. Research and training should go hand in hand". (I2-2)

The Twelfth Five-Year plan further underlined the relevance of the collaboration environment between universities, private and public sector corporations and global research centers. Many institutions have been quick to take advantage of the opportunities and thus have enjoyed international repute. However, the overall picture is not so good.

> "It is commonly held that Indian industry is myopic and risk averse and is often skeptical of collaborations with academic institutions. On the other hand, academic scientists are criticized for having failed to understand the commercial and technical needs of the industry. This is also linked to India's inability so far to nurture learning and innovation networks with participation from both the public and private sectors. Policy initiatives, however focused and well-intended, have failed to forge synergies and coordination in this direction". (I1-2)

The science, technology and innovation policy of 2013 took the initial steps of multiplying inter-university centers in various fields in order for researchers to be able to access advanced research facilities and equipment provided by private sector national laboratories. Furthermore, investments in basic research have been encouraged and many government departments have been "proactive in collaborating with the industry on public-private partnerships in an effort to incentivize the private industry towards R&D through shared costs and rewards" (I1-2, p.19).

The NITI Aayog, which operates under the Government of India, through its various programs has set up incubators for NGOs, SMEs and corporates that will collaborate and promote commercial and social entrepreneurship. Lastly, mentoring networks have been set up across the country where professional

experts, industry communities, researchers and students have the opportunity to come together to teach and learn from each other.

Availability of resources

The economic liberalization of the 90s resulted in a high growth trajectory. The following years demonstrated its strength in factors like gross capital formation, market capitalization and total value of stocks traded. This growth drove many firms to be listed on the stock exchanges that in turn increased market capitalization. Another success factor was the regulation of the financial market through the policy guidelines laid by the Securities and Exchange Board of India. Evaluation reports indicate that the country still has the potential to improve its financial structure by taking initiatives to attract large venture capital and angel investor community.

> "One of the most important gaps in our existing financial structure is the lack of a sufficiently large venture capital and angel investor community, who play a very important role in financing start-ups, especially in areas where technology is the key to success and risk capital is needed". (I2-3)

The areas where action needs to be taken are improving human capabilities in the form of skill development that would directly result in enhancing the quality of the labor force, institutional capabilities, development of infrastructure and lastly facilitating the ease of doing business and providing proper incentives.

> "To ensure that skills match demand, special efforts are needed to ensure that employers and enterprises play an integral role in the conception and implementation of vocational training programs, including managing Industrial Training Institutes (ITIs) and in the development of faculty". (I2-3)

> "In addition to the existing basic problem with the skill development system in the country, the urgency of skill development is underscored by the demographic changes taking place". (I2-1)

> "At present, the incentives and subsidies are so designed as to strongly penalize entrepreneurs for crossing a threshold size from a micro/small to a medium/large unit. The excise and other taxation policies need to be reviewed in this perspective". (I2-1)

With the boom in information and communication technology, the country was seen as a destination of low-cost software and IT enabled services. This also provided the opportunity to upgrade its vocational education and training system. The government has also ensured that the various ministries set up training establishments in their specialized fields. This has also meant setting up government bodies that have a special focus on the needs of women, children and unemployed youth.

With the digital age, setting up telecommunication infrastructure and broadening its access to all that been the central focus in the recent years. The previous National Innovation Council encouraged the creation of an 'Indian Model of Innovation' which aimed at providing quality and affordable innovative solutions that eliminate disparity and focus on inclusiveness.

> "Government is also leveraging ICT to reduce pendency in the legal system, encourage a move towards e-governance, e-procurement, e-tendering and e-office. It is also undertaking an ambitious initiative to connect 2,50,000 panchayats with fiber-based broadband to improve governance and service delivery at the last mile. A national geographic information system (NGIS) organization is also being thought of to map information, assets and data accurately, which will assist in policy and works planning and improve delivery of services in urban and rural areas". (I2-3)

Quite recently the government has implemented the GST (Goods and Service Tax) in place of all other indirect taxes that were levied earlier. The Twelfth Five Year Plan points out that this implementation represents a major modernization of the indirect tax system and would play a key role in simplifying the system and boost efficiency and revenue mobilization without raising rates. The implementation required a broad political support and the amendment of the Constitution.

Openness of the region

On the international dimension front, India has made enormous progress. The main factor identified has been the opening of the markets in the 1990s. Additionally, the Foreign Direct Investment (FDI) policy was also liberalized during the Tenth Five-Year Plan.

> "India has been pursuing a policy of market diversification directing her export promotion efforts at Asia and ASEAN, Latin America and Africa through Focus Market initiatives and bilateral trade agreements". (I2-3)

The "Make in India" program initiated by the newly formed government has been structured in a way that gives leading world businesses an opportunity to make use of India's talent base and in turn provide employment for its citizens. Furthermore, the government has also allowed up to 50% FDI in various sectors like retail, infrastructure, transport and defense.

Exports of goods and services have increased in addition to import duties being reduced over time. Investments to India and from India have seen an upswing. Setting up of the National Knowledge Network is one of the initiatives that has been implemented for the sole purpose of connecting, in real time, domestic educational and research institutes to global research networks.

> "India nonetheless had entered the 'club' of advanced as only a select group of emerging economies have national innovation policies". (I1-4)

On the domestic front, efforts are still required especially in areas related to attracting a larger proportion of international students to India, providing additional opportunities for faculties to visit institutions abroad and collaborate with them and lastly, examining and augmenting other industrial sectors and regions of India and creating a portfolio of these to supplement economic growth in the long term.

Government outlook

Most of India's economic growth have been influenced by its policy regimes and the progressive measures taken following the world trends. Early reports on India's policy assessment have cited that implementation of different initiatives and programs have been faced with problems. Too many process rules have guided this method rather than being interested in the outcome.

Given the country's vast size, the ministries within the state and the center have functioned in their own independent vertical repositories. Problems relate to design of policies, evaluation of their outcome and a lack of willingness to improve them.

> "Inter-ministerial consultations take far too long, and more importantly, are typically not oriented to resolving problems. This is because each Ministry works in a silo, applying its own rules and procedures. The effort is to seek a consensus if possible, with little ability to overrule positions taken by

> individual Ministries in the interest of a holistic problem-solving approach". (I2-3)

Moreover, India also faces a problem regarding dissemination of information. Schemes and initiatives introduced by the center and state governments are not effectively communicated to the citizens. Additionally, corruption is another crucial issue in the Indian governance that needs to be tackled.

On the other hand, private sector involvement has been steadily increasing in India compared to the formative years after the economic liberalization. The involvement of the private sector to augment the government's efforts is seen through actions taken in higher education and intervention in public sector R&D and infrastructure development. All the more, the government has come to realize the fact that a greater flexibility in the policy guidelines needs to exist since states in the country have different characteristics and an ideology of "one size fits all" needs to be changed. This would provide a certain degree of freedom for the states to make proposals according to their situations.

> "Recognizing the fact that "one size fits all" national guidelines do not take into account the characteristics of different States, which justifies a differentiated approach, a new system has been introduced with two major changes. First, each state will be able to propose modifications in the national guidelines to suit the particular circumstances of the state. Second, each state will be allowed full flexibility for ten percent of its allocation under each scheme, which can be used for projects, which depart even from the modified state specific guidelines. The only requirement will be that the project must be within the broad objectives of the scheme. This is designed to encourage innovation at the state level". (I2-3)

Reports have alluded to the fact that although the previous Five-Year plans have acknowledged the importance of decentralization of the planning system, it was not visibly seen in implementation. However, with a new government and the introduction of the latest science, technology and innovation policy, decentralization as well as cross ministerial activities are visible. The government has taken advantage of the digitalization not just in creation of data centers but also in creating applications of the flagship programs to make sure the government information, updates and decision making are available on an open government platform.

5 DISCUSSION

5.1 Overview

The main aim of this thesis was to compare the innovation systems and the various approaches to innovation policies taken by the governments in Finland and India. The action steps taken by the respective governments have been majorly directed towards facilitating, keeping up and integrating innovation and technological changes taking place around the world. In general, we can see that both these countries have undergone radical and incremental changes for the period of 15 years from 2002 until 2017. However, despite the progressive changes, the adaptive ability of Finland to implement policy changes was faster as compared to India, where there is generally a tendency for suggested changes to be met with hurdles and long process driven procedures.

Over the years the Finland has undergone tremendous ramifications to improve its innovation policies and consequently its innovation systems. From the data analyzed it can be seen that firstly the government has created an environment where no winners are picked but where the market is in charge of doing that. Secondly, a high level of trust between industries and universities has led to facilitating network-based collaborations. Thirdly, the government has encouraged individuals to become entrepreneurs and pursue their ideas into businesses. This has ensured that Finland is one of the few countries where there is immense potential and ease in creating and doing a business. Fourthly, the country is one of the frontrunners in adapting and utilizing the digital economy. Lastly, the country is politically stable, and the funding capital is accessed easily not just from the domestic agencies but also from the European Union.

Although these accomplishments have been strong, there are some areas that require improvements and additional efforts. Firstly, the international dimension has remained weak for a considerably long time. This domain also includes stimulating entrepreneurs and businesses to internationalize and explore foreign markets. Secondly, with globalization providing access to global financial markets, the government needs to find ways to induce risk taking ability for private and public enterprises and businesses. Thirdly, much of the research is aimed at being application oriented rather than increasing basic research. Fourthly, promoting knowledge about intellectual property rights management needs to be undertaken. Lastly, Finland still shows signs of a technology push approach rather than a demand and user orientation one

where technologies adapted are modified and made available according to the needs of the customers within the country.

On the other hand, India has risen remarkably well amongst the emerging economies and strived to improve its innovation system. From the start, it has taken advantage of the technological developments to establish a strong foothold in the information technology software industry. The creation of innovation clusters in some of the main cities has significantly increased international collaboration. Additionally, the open government platform and national flagship programs has made it possible for citizens to remain updated and be able to access information instantly. This has also improved private sector involvement to a much higher level.

There are many opportunities to improve on despite having come a long way. First and foremost, there is a strong urgency to boost the collaboration environment between universities, industries and research institutes. Secondly, with liberalized markets, increased foreign direct investment and increased ease of doing business already in place, the government still needs to revise tax incentives and subsidies in order to promote entrepreneurship and innovation activities. Thirdly, there is a call for reducing communication mismatch and long, inefficient process driven procedures by increasing accountability of government and ministries respectively. Lastly, similar to Finland, the government needs to deduce ways to increase basic research in the institutions rather than targeting research that is application based.

The table below summarizes the key points from the analysis and findings.

Categories	Finland	India
Growth environment (+/x)	+ Stable economy + No picking winners + Ease of doing business	+ Increased vocational training opportunities and technical competencies
Collaboration Environment (+/x)	+ High level of trust + High university-industry-institute partnerships	X Low trust X Low university-industry-institute partnerships
Availability of resources (+/x)	+ World class infrastructure +High skilled labor + High R&D expenditure X Inflexible labor markets and taxes X Lack of IPR knowledge X Need to attract venture funds and angel investing X Need for basic research	+ Foreign direct investment +Creation of innovation clusters X Lack of proper infrastructure X Lack of IPR knowledge X Need to attract venture funds and angel investing X Need for basic research X Need to improve human skills and capabilities
Openness of the region (+/x)	X Weak international dimension X lack of customer orientation X Induce risk taking ability	+ Progressive international dimension X Need to improve domestic dimension X Induce risk taking ability
Government Outlook (+/x)	+/x Decentralized operations but strong vertical silos X Lack of private sector involvement X Need for improved cross ministerial linking	+/x Decentralized operations but strong vertical silos + Increased private sector involvement X Need for improved cross ministerial linking

Table 1: Summary of the key points from the data analysis

In the consequent chapter, the findings related to this study are discussed in regard to the theoretical literature and previous research.

5.2 Contributions to theoretical literature in the study

The findings in this comparative approach of innovation systems' development and evolution complements the existing literature on national innovation systems which has identified the decisive role played by organizations, institutions and governments (Wang et. al 2018; Balzat and Hanusch 2004; Edquist 2011; Edquist and Hommen 2008; Arundel et. al 2007).

Today, globalization and technological advancements have played an integral role in shaping the world as we see it. This has led countries to respond in different ways depending on their internal capabilities of knowledge reserve and adaptive abilities. However, numerous studies have pointed out that national policies create a supplementary thrust to develop and maintain "national systems of innovation" and so research on these comparative studies have aided policy makers in deriving appropriate good cases practices and learning to ensure innovation led growth and welfare (Shyu et. al 2001; Balzat and Hanusch 2004). From the findings it can be seen that both Finland and India despite possessing different government structures, have responded in different ways in order to accommodate these changes. Finland on one hand can be seen to have used its internal capabilities in adjusting faster to the new reality, be it facilitating technological competence or joining the European Union to get access to a larger market or educational reforms to increase industry collaborations and increase high skilled labor output. India on the other hand has picked up these changes only after the internet boom. After that until the late 2010s it can still be seen adjusting to the changes.

Technological advancements have interconnected the world. The information and technology systems are extensively being used by companies and individuals alike. This makes it all the more imperative for governments to integrate them in the systems now in order to stay adept in the upcoming future possibilities and challenges. The resource-based theory (Barney 1991) and the dynamic capabilities theory (Teece et. al 1997) can be reinforced and further extended to not only be applied on a firm level but also on a national one. The information and communication technology infrastructure would serve as a primal base for governments to stay afloat and at par with the interconnected web now and in the future. Although the governments in the respective countries have acknowledged this fact and are seen to be taking substantial efforts and implementing various outreach programs, the utilization and implementation of the digital infrastructure in governmental systems post the digital boom has been slower. This finding is consonance with the reports that highlights the governmental readiness and adoption flaw. Therefore, this area of study calls for a further in-depth analysis to overcome the flaw in order

to help policy makers to be able to adopt technologies. This would in turn affect the national innovation systems research as well.

The findings have complemented the research on the emergence of open innovation (Chesbrough 2003). Open innovation process comprises of an exchange of outside and inside knowledge in a two-way interactive manner. The movement of knowledge along with the mix of core competencies speeds up the innovation process and creates an innovation inclusive environment. The governments in both countries through incremental steps over time have moved in direction of creating such an ecosystem. The initial step involved was to open the domestic markets. Successively over the years, the policies have favored internationalization not only for businesses and enterprises but also attracting global talent to the respective countries. The findings also suggest that both these countries need to further intensify their efforts in this domain.

The theoretical literature for national innovative capacity has described two streams of approaches, one being the formalized approach where country specific characteristics are taken into account and the other approach being clear cut advice for policy makers (Balzat and Hanusch 2004). Based on the findings in this study one can argue that there may be a bias towards the latter approach since it is easier for experts and decision makers to derive implications from either benchmarking studies or implement learnings from other country experiences. Additionally, the former approach would involve going through a great deal of intensive study which would take considerable time not only to diagnose the country conditions but also put into effect various policies. This could be regarded as a minor glitch that may have the ability to be treacherously fatal. Moreover, as every country is unique and so are its conditions, it may be better if only one form of approach is used as a guiding principle in national innovation capacity study so that policies are catered to nurturing the entities.

Another limitation of the national innovation systems approach is that it fails to be interconnected with the regional innovation systems research literature. Even for a country as small as Finland, the findings revealed that having a regional ecosystem is equally as important as having a national one. In the recent years, the different systems of innovations have evolved and developed in their own separate and individual ways. However, research studies that have combined essential aspects of both systems to study and compare economies have been limited. Henceforth for the future, literature that tends to combine both the national and regional innovation systems would be of greater significance as national level procedures, directives and components cannot

operate alone and the need to be utilized cohesively with the regional components.

Research on national innovation systems and national innovative capacity has been voluminous and far reaching. These studies have undertaken various quantitative methods by using country specific data and variables to determine the innovation intensity within a country. This study has made use of the aforementioned literature as well. However, the study takes the approach of analyzing innovation policies of Finland and India over a period of 15 years in order to explain how innovation systems in countries work, what changes have taken place over time and how have they contributed to the overall national development. In summary, the findings are in consonance with the framework of national innovation systems adopted in this study. On a national level, governments possess a far superior ability to enhance and foster growth and innovation activity. The national innovation system provides the opportunity to evaluate the nation's transformation and innovation process through different policies that if taken together affect competence building (Lundvall et. al 2002).

6 CONCLUSION

6.1 Concluding Remarks

Innovation assists in the progress of human welfare and development which in turn contributes in the economic advancement (Martin 2012). In addition, there is a stark contrast in the innovation processes across different regions and countries. The need to understand why the scenarios are as they are is what drives notable scholars and decision makers. The primary focus of this study has been to compare different approaches of innovation systems in Finland and India by studying innovation policies in order to shed light on what these changes are over time and how have they affected the overall development of the countries as we see today. The comparative approach is particularly directed to understanding how these two countries have integrated and facilitated digital transformation and innovation in order to drive economic growth within the respective territories. The study makes use of the well-known national innovation systems literature to support and supplement its findings.

Distinguished authors like Edquist (1997,2011), Freeman (1987) and Lundvall et.al (2002) have recognized firms, government bodies and institutions to play an indispensable role in constituting the innovation systems in a country. To determine innovativeness of a country, researchers have made use of country specific variables and quantitatively analyzed their interplay as one form of method. Another way of determining the result has been to focus on international comparisons of a system (Balzat and Hanusch 2004). By understanding and analyzing how systems functions, many policy implications can be derived. In the same way comparing different systems can be used for exchanging best case practices and knowledge. Consequently, in order to understand a system, it is essential to identify the main elements and the strength of their linkages.

By using the latter approach, innovation policies of Finland and India were analyzed from 2002 until 2017. The findings from the data illustrate that both Finland and India have undergone structural changes in governance and national policies that are both radical and incremental in nature. By analyzing government reports and articles from the respective countries, it could be seen that the changes and modifications being undertaken and implemented catered to five categories, namely, *growth environment in the country, collaboration environment in the country, available resources, openness of the region and the government outlook.* The changes taken place throughout the period have created the national innovation systems of the countries as they are today through

policy steering by the governments. The results also point out that, the architecture of the governments impacts the residing institutions, individuals, businesses and organizations alike.

For the new digital economy to take shape it is crucial to have the befitting conditions already in place. This also implies that for long term and broad-based gains to take place, there is a need to effectively manage the information and communication technologies infrastructure and corresponding policies. In light of the technological advances, governments need to be every bit as responsive and at par with it as are businesses and institutions. Moreover, it is also necessary that to form a resilient digital economy, many changes in leadership and governance need to be undertaken. This is equally true for both developing and developed countries. Without a strategic agile governance framework in place, it would be increasing difficult to shape the impact of the information technologies and adapt to the changing situations, be it a developed country like Finland or a developing one like India.

Additionally, governments need to pay attention to the fact that creating provisions for increasing R&D inputs and patent filings are not sufficient to improve a country's economic development. Furthermore, it can also be argued that world rankings, even though of considerable importance do not give a comprehensive picture. From the study and findings, it can be summarized that by comparing a developed and developing country and analyzing the evolution and approaches to the changes brought about helps in understanding the actual stance of the economies and a gives a peak at where they would be headed in the future.

Technologies change faster than governmental regulatory regimes. This can have both positive and negative effects. Improved rate of technology adoption and usage means higher innovation diffusion that may result in growing competitiveness of the regions. Similarly, the radical technological changes need to be controlled and monitored keeping in mind the asymmetries that could take place in social, economic and environmental context. Thus, a concentrated effort needs to be made to align and adjust innovation policies to foster framework conditions in the regional, economic and institutional spheres which can play determining role in improving the innovative, absorptive and adaptive capabilities (Crescenzi 2005; Rodrigues and Crescenzi 2008).

6.2 Limitation and Implications

There are two crucial limitations to this study that need to be addressed. The first and foremost is the need for primary form of data. Two main barriers were the limited time frame to conduct the research study and secondly the inability to obtain contacts of the key stakeholders in both the governments. Although this study was undertaken using articles and reports strictly from government databases, the study would have been richer and more in depth had there been any form of primary data. Interviews, for example, with government officials and key decision makers would have been ideal to get more insight on the research topic.

The second limitation of this study can be attributed to the distinct sizes of both the countries. Finland is a relatively smaller country in area as compared to India. In the Indian economy, the state plays an equally important role to foster growth within the regional clusters. Additionally, with a larger area, a higher level of administration and jurisdiction is required, even more so from the state which is not the same case in Finland. With a larger size also come a higher proportion of human population and increased disparity, which is the case in India.

On the other hand, this study offers several implications for the future. Foremost, innovation policies reflect the competitiveness of the nation and so their primary objective should focus on restructuring the glitches and frailties in the innovation systems. Additionally, innovation policies should cover education, technology and industrial policies but not be limited to them only. These need to be tapered to the existing local and regional conditions.

Second with increased private sector involvement particular attention should be paid to developing strategies that aid the faster diffusion and transfer of knowledge. This can be enhanced by increasing interaction among all agents in the ecosystem, increasing capacity of institutions, global collaborations and inducing technological and non-technological investments. Third, there is strong bias towards high technology sector in almost all countries. This can be attributed to the high rate of innovation in these sectors. However, it needs to be kept in mind that innovation affects the macroeconomic performance of all kinds of firms and industries. The effects of depending on one area of the economy can be clearly seen from Finland in this study. Thus, it is highly required that in the face of global competition, countries need to encourage multiple sectors of the economy to adapt to the digital age.

Fourth, with interconnected global networks, there may be a shift in the traditional concept of national innovation system in the near future. This could be regarded as the internationalization of national innovation systems where knowledge transfer and learning occurs via international cooperation. This may even lead to a whole new field of research literature.

6.3 Recommendations for policy makers

Every technological transformation comes with opportunities to be harnessed and challenges to cope with; the digital transformation is no exception. Research literature, international reports and findings from this study ascertain the fact that businesses and individuals alike are faster to make use of technologies than governments. Thus, this section addresses some key recommendations for policy makers that may provide them with additional insight and help with staying abreast with the changes.

First and foremost, it is essential for policy makers in the countries to take a unified government approach. The incremental improvement approach or "muddling through" as it is more commonly referred to is the principle that has been used in almost every country to cope with challenges which were based on a linear developmental model. But with a world that has increasingly become cross-societal, an incremental improvement would lead to structural rigidity. Hence, we can still see in the case of Finland and India both that even with decentralized operations the vertical silos of departments still remain. This creates the semblance of multiple governments instead of a single, unified one.

To indulge in transitioning into one unified approach some of the following method adjustments could be of use. Ministries and government departments need to be given actionable tasks based on the governmental national agenda. The policy makers need to ensure that these tasks incorporate clear measurement indicators and can be either acted upon separately or in collaboration with other ministries but need to fit within the overall national framework. These tasks would also call for specific commitments of implementation from ministries and thus would increase their accountability. Additionally, there is potential to embellish reporting from ministries to the government and assist in creating a bottom up interaction.

Another possibility is to increase task force committees but in such a way as to bring in experts and preserve the cognitive diversity of the group simultaneously. This combination has the ability to furnish fresh inputs and

outlook into policy making and amalgamating results and mechanisms into ministerial and political processes. Moreover, another adjustment that needs to be highlighted is related to the government standpoint on the corporate environment. From the study it could be seen that liberalization of economies has engendered significant business growth internationally. However, merely adopting this is not enough to encourage individuals to be entrepreneurial. Additionally, even creating an environment that provides an ease of doing business is not enough either. The missing catalyst is to encourage businesses and individuals to experiment and reward well managed failures. This would not only induce risk taking ability but also provide an impetus to create regional ecosystems that thrive on learning and sharing knowledge.

The second important recommendation for policy makers is to develop committees for skill development at the national and regional level. These would provide the opportunity not only for individuals to make use of but also implementing these within ministries can help augment the capabilities of the ministers. The main idea to allocate skill development facilities is to enrich the human capital within the economy. This human capital is the knowledge stock which needs to continuously be kept up to date. It is imperative for governments to not be bogged down by various competitive and statistical reports of countries but rather direct attention towards adopting a strategic agility mindset rather than a continuity planning one. Providing the means to boost human capabilities by incorporating skill development facilities along with adopting and altering best case practices to suit regional needs would be beneficial in the long run and for economic growth.

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APPENDIX 1 : DETAILED SUMMARY OF REPORTS USED

Year	Code Number	Country	Article/Report Name	Publisher	Number of Pages
2017	I2-8	India	Annual Report 2017-18	NITI Aayog	140
2017	F2-2	Finland	From the trails of democracy towards future participation	Sitra	58
2016	I1-4	India	Policy Brief: Science, Technology and Innovation Policy in India. Some recent changes	Center for Social Innovation. Indigo Policy	19
2016	F1-13	Finland	Finland, a land of solutions. Mid-term review, Government Action Plan 2017-2019	Prime Minister's Office	78
2016	F2-6	Finland	Leading the cycle-Finnish roadmap to a circular economy 2016-2025	Sitra	56
2016	F2-3	Finland	Governing the welfare state and beyond	Sitra	44
2016	F2-5	Finland	Megatrends 2016	Sitra	56
2015	I1-1	India	Technological Innovation challenges and opportunities in India and the developing countries	Department of Science and Technology	6
2015	I1-3	India	Science, Technology, Innovation in India and Access, Inclusion and Equity: Discourses, Measurement and Emerging Challenges	Research and Information Systems for Developing Countries	45
2015	I1-7	India	Policies to drive Innovation in India	Department of Science and Technology	10

2015	I1-11	India	Technology Vision 2035	Technology Information, Forecasting and Assessment Council (TIFAC)	59
2015	F1-11	Finland	Intangible value- The new economic success factor	Ministry of Employment and the Economic, Enterprise and innovation Department	48
2015	F2-9	Finland	Technology as an enabler of sustainable wellbeing in the modern society	Sitra	36
2015	F2-10	Finland	The opportunities of a circular economy for Finland	Sitra	72
2015	F2-12	Finland	Towards a sustainable well-being society. From principles to applications	Sitra	18
2014	I1-2	India	An assessment of India's innovation policy	Research and Information System for Developing Countries	64
2014	I1-6	India	Understanding Innovation: Indian National Innovation Survey.	National Science and Technology Management Information System (NSTMIS), Department of Science and Technology	343
2014	F1-3	Finland	Development of key performance indicators and impact assessment for SHOKs	Ministry of Employment and the Economy	46
2014	F1-10	Finland	Innovation, Firm risk and Industry productivity	The Research Institute of the Finnish Economy(ETLA)	18
2014	F1-12	Finland	Openness, Specialization and	The Research Institute of the	30

			Vulnerability of the Nordic Countries	Finnish Economy	
2014	F2-4	Finland	Governments for the Future: Building the Strategic and Agile State	Sitra	52
2013	I1-5	India	Science, Technology and Innovation Policy 2013	Ministry of Science and Technology	22
2013	I2-3	India	Twelfth Five Year Plan (2012-2017)	National Planning Commission	370
2013	I2-4	India	Twelfth Five Year Plan (2012-2017): Economic Sectors	National Planning Commission	438
2013	I2-5	India	Scenarios: Shaping India's Future	National Planning Commission	85
2013	F1-1	Finland	21 Paths to a Frictionless Finland	Ministry of Employment and the Economy	37
2013	F1-8	Finland	Industrial Competitiveness Approach	Ministry of Employment and the Economy	59
2013	F2-11	Finland	Towards a sustainable well-being society: Building blocks for a new socioeconomic model	Sitra	44
2011	F2-1	Finland	Forget Innovation	Sitra	157
2011	F2-7	Finland	Strategic Agility in Public Management	INSEAD-Sitra Cooperation	29
2010	F2-8	Finland	Sustainable Innovation: A New Age of Innovation and Finland's Innovation Policy	Sitra	145
2009	F1-9	Finland	Evaluation of the Finnish National Innovation System	Taloustieto Oy (on behalf of the Ministry of Education and the Ministry of Employment and the Economy)	97

2008	I2-1	India	Eleventh Five-Year Plan (2007-2012)	National Planning Commission	306
2008	I2-2	India	Eleventh Five-Year Plan (2007-2012): Economic Sectors	National Planning Commission	537
2008	F1-6	Finland	Finland's National Innovation Strategy	Ministry of Employment and the Economy	50
2006	I2-6	India	Technology Innovation and Venture Capital	National Planning Commission	24
2006	F1-2	Finland	Knowledge and Innovation Subsidies as Engines for Growth: The Competitiveness of Finnish Regions	The Research Institute of the Finnish Economy	154
2002	I2-7	India	India Vision 2020	National Planning Commission	108