LUND UNIVERSITY • CENTRE FOR EAST AND SOUTH-EAST ASIAN STUDIES

Japan's Legacy of Technology in the Digital Era

A Mixed Methods Analysis of the Competitive Advantage of the IoT sector in Japan

Author: Marketa Urbanova
Supervisor: Stefan Brehm

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Abstract

The purpose of this thesis is to investigate whether Japan achieves a competitive advantage through digital technologies in order to enhance its socio-economic prosperity in this highly connected world. The author analysed the competitive advantage of Japan's ICT sector with a particular focus on IoT through Porter's Diamond Model of National Competitive Advantage. The main motive behind choosing this sector is academic suggestions that technology innovation can boost productivity, and therefore, foster the current development. Technology has had a distinct place in Japanese development since the 1970s when the country recorded its first significant economic success. The mixed-method research was conducted by collecting data from governmental (public) and non-governmental (private) sources in order to analyse the major components of the competitive advantage. The analysis revealed that the key drivers of the competitiveness within the respective sector are influencing each other negatively. Specifically, Japan lacks technology-oriented labour force and startups driving innovation. The analysis also revealed that well-established corporations hold a strong role within competitiveness of Japan as they are closely tied with the government through networks. Hence the research concludes that the competitive advantage of Japan is rather weak with respect to contributing to the socio-economic development of the country.

Keywords: Japan, IoT, ICT, technology, digital era, competitive advantage, nation

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- THANK YOU

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Abbreviations

GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
JETRO	Japan External Trade Organization
ICT	Information and Communications Technology
IoT	Internet of Things
METI	Ministry of Economy, Trade and Industry
MEXT	Ministry of Education, Culture, Sports, Science and Technology
MIAC	Ministry of Internal Affairs and Communications
MITI	Ministry of International Trade and Industry
R&D	Research and development

1 Introduction

The following section reveals the factors, which serve as the main motives for the topic of this thesis. The author discusses the economic struggle of Japan in terms of weak growth since the 1990s. Further focus is oriented towards technology because it is considered to be a potential contributor to a better socio-economic state in Japan in the current digital era. The purpose of the research is derived from the motivating factors and drives the direction towards the Internet of Things (hereafter IoT) sector. Through this sector it is feasible to analyse the technological environment in Japan. Lastly, the outline of this thesis allows for a better overview of the research structure.

1.1 Motivation

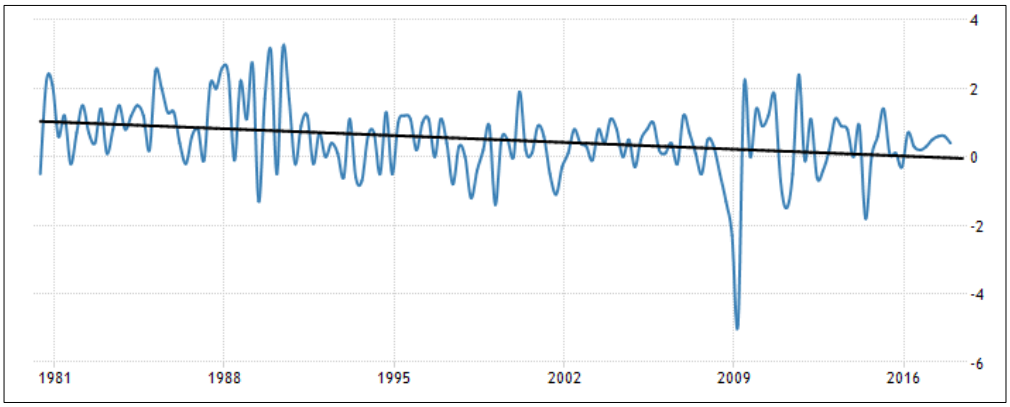
Japan is an island in East Asia that is acknowledged for its past economic success and technological leadership (Karan, 2010). This is a well-deserved acknowledgement, in particular if one considers the country's fast recovery after World War II. Trading policies, subsidies, financial and technological aid from the U.S. were among the wide array of sources that enabled the country to become the first East Asian economic miracle between the 1950s and 1970s (Kingston, 2011). In this period, Japan enjoyed sustained high growth GDP with 8.4% at an average rate (Kingston, 2011). However, global events such as the oil crisis in 1973 had its effect on the Japanese economy and started a series of challenges that the Japanese government had to overcome. Rising wages and increasing competition resulted in a decreased GDP growth from 8.4% to 3%, which affected the country's competitiveness (Kingston, 2011). After the oil crisis, Japan was able to catch-up with the global economies but the growth did not return to the same pace as before the crisis.

As Japan is associated with an economic miracle, it is also associated with the economic debacle that is known under the term 'Lost decade' (Kingston, 2011). Since the 1990s, Japan's economy has been in recession due to the asset bubble (Hart-Landsberg & Burkett, 1998), which contributed to the debt crisis in East Asia in 1997 (Ikeda, 2004). Afterwards, several global and domestic events such as the global financial crisis in 2008-2009, the Euro-crisis in 2011-2012, and Japan's triple disaster in 2011 have contributed to the weak growth of the Japanese economy (Harari, 2013). These have further deepened already existing socio-economic issues in the country, such as shrinking labour force and increasing unemployment

rate (Kingston, 2011). Here comes the connection between the economy and overall prosperity of the nation. If Japan's economic performance further declines, it can be expected that the citizens will be affected with a resulting higher unemployment, lower salaries and higher taxes.

Figure 1 illustrates that despite a few recent spikes in GDP growth and current positive projections (Akiyoshi, 2018), the average GDP growth rate is continuously declining. Moreover, Japan is currently the most indebted country in the world with a national debt of 235% of total GDP (OECD, 2015). Therefore, Japan currently stands on the brink of a highly connected and competitive world. The country needs to reinvent itself from a risk-averse nation with chronic corporate structures into a nation that is agile and innovative. However, this also makes it necessary to raise the question: What might help Japan to boost its economic prosperity given that we live in a globalized world of the 21st century, where digital technologies has earned enormous significance due to the birth of the Internet?

Figure 1. Japan GDP Growth Rate



Source: Trading Economics (2018)

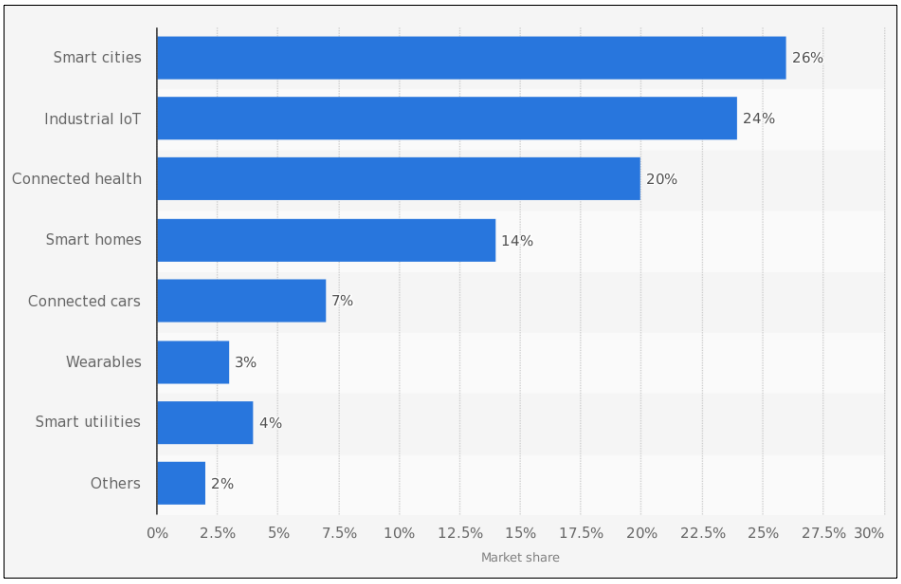
According to Blakely (2001:133), "technology-based globalization is clearly the new paradigm for local economic development strategies" across the world. This is aligned with the neoclassical thought that technology is vital for increasing productivity (Desai and Potter, 2014). Nevertheless, it is reasonably assumed that technology can support the development in a broader perspective than the 'measurable' economic one. In fact, technological change shares a common feature with the development rather than growth because it is pervasive and continuous (Porter, 1990a).

Technology has a distinct place in Japan's development because of the historical success of consumer electronics, robotics and automobiles (Karan, 2010). Japan is still ranked among the highest technologically mature nations. For instance, in Bloomberg's innovation index, Japan ranks overall as the second most innovative country based on various measures such as R&D, high-tech companies or patent acquisition (Coy, 2015). The Japanese government holds an essential role through its long-lasting commitment to science and technology, which is believed to improve demographic and economic conditions at the same time (Jorgenson and Motohashi, 2005). Both academic and commercial sources support this idea. In their book, Desai and Potter (2014) state that technological change is vital for increasing productivity in the 21st century. Yet, Japan needs to shift its focus towards the technologies prevailing in the contemporary era.

The advent of the Fourth Industrial Revolution[1] is concerned with newly established sectors such as IoT (Frangos, 2017). It can be derived from the term that IoT is about machines and devices communicating via Internet (Myers, 2016). Such devices are not limited to smartphones, laptops and tablets, but it involves sensors that give rise to smart cities, smart homes, connected cars or health tracking devices (see Figure 2 illustrating the share of the global IoT sub-sectors in 2017). Therefore, IoT has the potential to improve lives by solving problems on mass scale (Myers, 2016). Through IoT it may be possible to tackle demographic as well as economic issues because it brings new opportunities for businesses in terms of new business models, cost transformation, operational efficiencies and improved customer experiences (Myers, 2016).

[1] According to Schwab (World Economic Forum, 2018:n.p.), the Fourth Industrial Revolution "is characterized by a range of new technologies that are fusing the physical, digital and biological worlds, impacting all disciplines, economies and industries, and even challenging ideas about what it means to be human."

Figure 2. Worldwide share of the IoT market by sub-sector in 2017



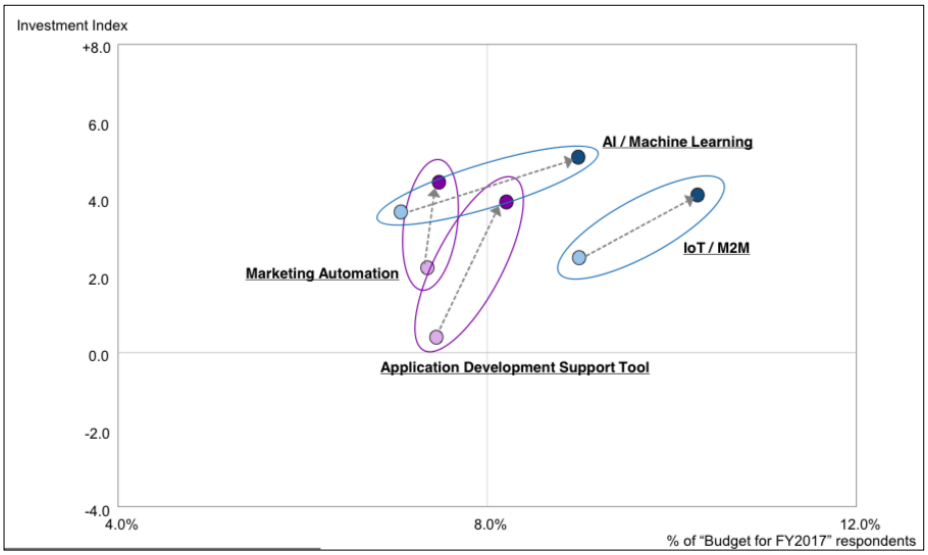
Source: Statista (2018a)

Recent governmental strategies[2] suggest that Japan realizes the need to shift towards new technologies. According to the Ministry of Internal Affairs and Communications (2014:2), the mission of the country is emphasized in *Smart Japan ICT Strategy* as following: "to be the most active country in the world – Realizing Japan's economic growth and contribution to international society through innovation by ICT" Additionally, Japan introduced a new governmental program called Society 5.0. (CEBIT, 2017). This program is supposed to move Japan ahead of its competitors such as Germany, the U.S., South Korea[3] and China (Lewis, 2017) in terms of digital development. The aim of the country is to create a 'super smart society' through targeting not only companies but also individuals and community life (Granrath, 2017). As it can be seen in Figure 3, it is apparent that IoT is already placed in the centre of the digital transformation of Japan (ITR Corporation, 2017) and it is forecasted that the revenue will amount to 175.92 billion U.S. dollars in 2020 (Statista, 2018b).

[2] Among strategic documents developed by the Japanese government are for example: Society 5.0., i-Japan Strategy 2015, Digital Economy in Japan and the EU, Japan's Revitalization Strategy 2014 and Smart Japan ICT Strategy 2014 to list a few. Additionally, IoT is on the top priority list in the economic revival plan 'Abenomics' launched by Prime Minister Shinzo Abe (Lewis, 2017).

[3] In Bloomberg's innovation index (Coy, 2015), South Korea is ranked as the most innovative country.

Figure 3. Most focused technology 2016/2017



Source: ITR Corporation (2017)

Despite all above-mentioned facts, which lead to an assumption that IoT plays an important role in the economic development in the 21st century, this research area is currently understudied. Most of the existing research analyses IoT from the technology perspective. The reason could be that IoT is a new technology, which is 'only' part of the future predictions. This strongly underlines the main motive of this thesis which is based on three prerequisites: 1) technology is part of Japan's 'DNA'; 2) IoT is recognized as a vital source of social and economic advancement; and 3) the Japanese government is aware of the need to shift focus towards IoT.

1.2 Research Question and Purpose

Based on the outlined motivation in the earlier section, the purpose of this thesis is to investigate whether there is a competitive advantage in the IoT sector in Japan, which consequently could be a source of potential socio-economic development. Therefore, the research question of this thesis is as follows: *Does Japan have a competitive advantage in the IoT sector that could potentially strengthen its development in the current digital era?*

The term 'competitive advantage' has origins in business and it was coined by Michael Porter in the late 1980s (Sölvell, 2015). Porter's aim was to understand the factors enabling a firm to beat its rivals (The Economist, 2008). Through his findings, he argued that a firm can outperform its competitors if it provides either low-cost or unique products or services (The

Economist, 2008). Later on, when the world has become more globalized, the concept of competitive advantage has been applied not only to products and services, but also to measure the competitiveness of nations. Porter (1990a) conceptualized the competitive advantage of nations due to increasing global competition and the increasing importance of nation.

Every country differs through its values, culture, economic structures, institutions, and history. All of these factors influence and contribute to its competitive success (Porter, 1990a). However, a significant premise for a nation's competitiveness is whether a nation's industry has the capacity to innovate and upgrade (Porter, 1990b).

Hence the purpose of this thesis is to map and evaluate a specific industry in Japan - IoT within ICT, which is part of discussions in Japan regarding its future development. Search results in Google Trends (2018) provide an insight that further supports this argument. Since 2009, the search volume of the terms 'internet of things' and 'IoT' has been exponentially increasing worldwide, as well as in Japan, which means that it is attracting attention of a wider audience and not only the industry experts.

Moreover, the earlier section informs about the connection and similarities between the development and technological change that is represented by the IoT sector. The terms *growth* and *development* are often used interchangeably. Therefore, it is important to mention why this paper addresses development rather than growth despite the fact that Japan is categorized as a developed economy (United Nations, 2014). The definition of growth has limitations because it is a narrow concept that does not apply beyond economic quantitative measures, while development is continuous long-term process attaining both qualitative and quantitative changes, which contribute to the society as a whole (Ezeala- Harrison, 1996).

The research question is further supported by three sub-questions in order to provide comprehensive analytical insights to the research phenomenon.

The first sub-question *'What was Japan's competitive advantage and which sectors helped Japan to become the East Asian economic miracle?'* enables to reveal competencies of the country in the past in order to find out whether these competencies have changed or not.

The second sub-question *'What is the role of the Japanese government in the competitiveness of the IoT sector?'* allows analysing the participation of the government in the technological change of the country that is required in order to fuel its development. This sub-question may further reveal if the Japanese government interacts with players from the industry or only fulfils its broader political agenda.

The last sub-question *'How competitive and how developed is the IoT sector currently in Japan?'* completes the scope of the research through the analysis of the IoT sector, which is based on Porter's (1990a) Diamond Model related to the concept of the competitive advantage of nations.

Last but not least, the paper is limited to the analysis and evaluation of the IoT sector in Japan. Although it is aforementioned that technological change, specifically in the IoT sector, holds an opportunity to improve Japan's development and foster economic growth, this thesis does not measure such an impact. The reason for this is that the 'new digital economy' where IoT and ICT belong to has not yet recorded any significant economic outcomes (van Ark, 2016). According to van Ark (2016:16), the new digital economy is still in the installation phase, which is characterized by producing only "random and localized gains in productivity in certain industries and geographies". It needs to overcome a forecasted crisis that may arise due to overly high expectations. At the time when the technologies of the new digital economy are widely accepted, consolidated, expanded to new markets and driven by the demand (i.e. deployment phase), it is assumed to generate more gains (van Ark, 2016).

1.3 Outline

The outline of this thesis is divided into five parts. The first section introduced the main motives of the research phenomenon, which involves the discussion regarding the economic slowdown of Japan in comparison to its 'miraculous' age. Technology is arguably perceived as a potential opportunity for Japan to foster its economy. This further led to the purpose of the research with the research question as the central pillar. The second section introduces the theoretical framework. Porter's theory of the competitive advantage can provide new insights into industries that nowadays receive a wider attention. The third section aims at explaining the prior studies within economic development of Japan with the narrow focus on industry, technology and innovation. This not only defines the literature gap but it also enables to understand what Japan did in the past in order to understand the presence. The fourth section

reveals the methodological approach and research strategy. After the data collection, the following fifth section discusses the major findings of the research, which further leads into the conclusion where the author answers the research question and brings new insight into the research phenomenon.

2 Theoretical Framework

This section discusses the theoretical framework, which is based on Porter's theory of the competitive advantage of nations. Porter's theory provides different approach to study economic development through the advancement of an industry. This approach is considered to be the most suitable for the purpose of this research because it departs from prior explanations of economic development in Japan that are discussed in Literature Review.

2.1 Competitive Advantage of Nations

Competitive advantage is a term that was coined by Porter (Sölvell (2015) and is defined as "[a] condition or circumstance that puts a company [or a nation] in a favourable or superior [...] position." (Oxford Dictionaries, 2018:n.p.). The competitive advantage of nations has risen from the business concept due to the increasingly globalized world where nations has gained more power than before (Porter, 1990b). It was the success of Japan that sparked the discussion in the U.S. regarding the competitiveness of a nation (Sölvell, 2015), and shifted the focus from the performance of a firm to the performance of a nation (Grant, 1991). Therefore, Porter tried to find out what were the key driving factors of the most prospering and competitive nations such as Japan, Germany, Switzerland, USA, Sweden or Italy (Grant, 1991).

According to Porter (1990b), prior explanations of a nation's competitive advantage (embedded in economic theories of trade), which were based on macroeconomic determinants, access to natural resources, government policy or management practices, are insufficient. Several country studies disprove these explanations. For instance, living standards in Germany were rising despite budget deficits and the competitiveness of the country was not affected by the limited natural resources (Porter, 1990b). Moreover, management practices of a small Italian firm could not be applied in Germany (Porter, 1990b). Earlier traditional approaches explaining the competitive advantage were assigning the success only to companies or governments (Porter, 1990b). Porter has recognized the

need of a multilevel theory that would connect firms, industries and nations (Smit, 2010), and therefore contribute to the analysis of international trade and investment, and consequently to the economic development of nations (Grant, 1991). Porter has placed firms at the centre of the national advantage rather than assigning the role solely to the government as it is done by the developmental-state economists. In the case of Japan, it is relevant to study Japan's competitiveness through Porter's managerial framework because corporations are the backbone of the economy. The corporate investment has recorded significant linear growth since the 1990s reaching 69.2% of GFCF (gross fixed capital formation) in 2016 while general government investment is continuously declining during the same period with a total amount of 15.5% of GFCF in 2016 (OECD, 2016). Moreover, the industry in Japan is slowly reaching the same level as before the crisis in 2008. In 2016, it contributed to GDP with 29.5% (World Bank, 2016).

Porter (1990b) recognizes productivity as the only meaningful concept for a nation's competitiveness because productivity enables a nation to achieve and sustain a long-run standard of living (Porter, 1990b). Arguably, "[n]ational competitiveness has become one of the central preoccupations of government and industry in every nation" (Porter, 1990b:76). It is companies and industries that need to strive for improvements in order to strengthen the economy because national prosperity is not inherited but created (Porter, 1990b). According to the theory, the competitive advantage has the potential to rescue international economics (Grant, 1991). This notion provides the foundation for Grant's (1991) criticism because according to him, Porter fails at the explanation of economic development at the national level through the analysis. "There is inconsistency in the definition and measurement of competitive advantage as the analysis moves from the industry to the nation" (Grant, 1991:541). In Grant's (1991) point of view, Porter should measure the competitive advantage through export and outbound foreign investment. This may be the reason why Porter's theory did not secure its place in the economic field but it rather landed in the field of management (Smit, 2010).

Despite other disagreements originating from scholars such as Krugman or Kohler (1994; 2006; cited in Smit, 2010) who do not believe that countries compete in a similar way as companies do, Porter's theory has opened up a new discussion because it distorts the traditional economic thinking (Ranchhod, 2006; cited in Smit, 2010). It needs further development in order to find out how the competitive advantage can be measured. However,

it does not affect this thesis because it uses Porter's theory as a framework in order to analyse the industry in Japan. Despite the above-described criticism, Porter's theory is considered suitable for the purpose of this thesis because companies are the backbone of trade in the globalized world, which is a fundamental element of the economic performance of a nation. Companies also actively engage with the governments such as in the case of 'Japan Inc.' that is characterized by strongly tied government-business relations in Japan during the economic boom (Kingston, 2011). Additionally, the role of the companies in the Japanese economy is apparent from the fact that Japan has the highest amount of listed companies per 100 000 people in comparison with the U.S. and Germany (METI, 2017).

2.2 The Diamond Model

Innovation, i.e. new ways of doing things, is vital for a company to achieve a competitive advantage (Makino, 1987; cited in Herbig, 1995; Porter, 1990b). The same applies to a nation, whose success depends on whether it has a dynamic, challenging and forward-looking domestic environment (Porter, 1990b). However, it is impossible that a nation can be competitive in all industries. Thus, Porter's (1990b) study focused on 10 developed countries, including Japan, and their specific industries in order to identify patterns of competitive success.

Through his four years of study, Porter has found four broad attributes that constitute the so-called Diamond of National Advantage (Sölvell, 2015; Porter, 1990b). Using his Diamond Model, Porter was able to explain long-term survival of Japanese car manufacturers in global markets against U.S. car manufacturers (Sölvell, 2015). Hence, this research uses the Diamond Model as a framework for the analysis of IoT, as a currently growing industry, to contribute to the discourse of the competitiveness of Japanese industry which eventually supports the development of the country.

The Diamond Model comprises of four interrelated microeconomic drivers. *Factor Conditions (1)* are defined as factors of productions such as human resources, physical resources, knowledge resources, capital resources or infrastructure (Smit, 2010). Further, there are two categories of these factors - basic and advanced - which are in a complex relationship (Grant, 1991). Basic factors may provide initial advantages because they are inherited and do not require a significant investment (unskilled labour, raw materials, climatic conditions or water resources) (Grant 1991; Smit, 2010). On the other hand,

advanced resources are the ones that Porter considers as the basis for the competitive advantage because they require reinvestment and innovation (Smith, 2010). It may include infrastructure, sophisticated skills and research facilities or specialized institutions (Grant, 1991). Such factors should be scarce and highly specialized to the needs of an industry (Porter, 1990b). There should exist institutions such as in the case of Denmark that has two hospitals specializing in diabetes, which helps the country to have the competitive advantage in pharmaceutical sector treating diabetes (Porter, 1990b).

The second driver is *Demand Conditions (2)* that are based on the character of domestic demand for the product or service of the specific industry. If there are sophisticated buyers with high standards, it may force companies in a given industry to innovate faster. According to Porter (1990, cited in Smit, 2010), there are three main conditions of demand i.e. sophisticated and demanding buyers, home demand that projects into international demand, and industries that attain a significant share of domestic demand. Moreover, local circumstances and values can spark the needs of other nations as well, which might open the doors to international markets.

The third driver is defined by *Clusters (3)*, i.e. network of suppliers and other related industry players with vertical (buyer-seller) or horizontal (common technology, customers) relationships (Porter, 1990b). Interaction in these relationships can be mutually advantageous because the cooperation in a created environment of clusters may lead to cost-effective inputs, which can be transferred faster, earlier and in an efficient or preferential way (Porter, 1990b). Due to their geographical concentration (proximity), clusters enable supporting industries to work more closely and thus communicate better and exchange ideas. Porter (1990b:87) sees clusters as a "vehicle for maintaining diversity and overcoming the inward focus, inertia [and] inflexibility [...] that slows or blocks competitive upgrading and new entry". Furthermore, clusters can cause a spill over effect in terms that new industries can benefit or emerge, such as in the case of Japanese dominance in electronic keyboards that grew out of success in acoustic instruments (Porter, 1990b). More recently, Silicon Valley can be perceived as a good example of a cluster, which offers dynamic externalities that lead the innovation (Sölvell, 2015). In the case of Japan, it can be assumed that the keiretsu[4]

[4] Keiretsu are corporate groups in Japan characterized by mutual shareholding (Karan, 2010) and long-term relationships between banks, shareholders and other business partners (Gerlach, 1992). The companies that are

system corresponds with Porter's definition of clusters, which enhance the relevance of analysing Japanese industry through the Diamond Model.

The last block that closes the Diamond Model is *Firm Strategy, Structure and Rivalry (4)*. Here Porter (1990b) identifies management practices, organizational models, goals of the company and individuals, and intensity of rivalry as other important determinants of the competitive advantage of an industry. It is various systematic practices of the business sector that can also affect the competitive advantage because there does not exist one universal managerial system. For instance, Germany is known for its technology and engineering-oriented management system that would not work well within Italian footwear industries. Porter (1990b) also emphasizes that individual motivation to work and outstanding talent are scarce resources of any nation.

Additionally, the existence of domestic rivalry is one of the most important pre-conditions that push the innovation further (Porter, 1990b). Fiercer domestic rivalry may affect other factors such as that local industry players will need to decrease the cost and improve quality of the products or services. Japan for instance decreased its use of manual labour via automation, which consequently has lowered the cost of production (Porter, 1990b).

Altogether, the four drivers constitute an interactive system but there needs to be an interplay between them in order to lead to the competitive advantage of countries (Smit, 2010; Porter, 1990b). The process of creating the competitive advantage is not fast because it requires skilled labour, investments, building clusters and entering foreign markets. Therefore, it may take up to ten years until the industry gains the competitive advantage. Only then, we may be able to measure its impact on the economic development, which is such criticized element in Porter's theory.

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part of keiretsu have a preference for purchasing from other members of the group. Keiretsu are especially significant between automakers and suppliers. Some of the most significant keiretsu are Mitsui, Mitsubishi, Sumitomo, Fuyo, Sanwa, and Dai-Ichi Kangyo (Gerlach, 1992). However, their weakness came on the surface during the recession when the strong ties between members affected the small companies that devoted their resources to one big corporation, which gained control over them (Karan, 2010).

2.3 Beyond Porter's Diamond Model

Porter (1990b) has had an additional thought on the role of the government. He did not include the government in the Diamond Model because the role of the government is only influential via economic policy (Smit, 2010). According to Porter (1990b), the government should not be directly involved in the process of creating the competitive advantage of nation (interfere into currency and market). Nonetheless, the government should not leave it up to the invisible hand of the market either. Porter (1990b) has suggested that the government should be the catalyst that encourages or pushes the performance of the companies. The role of the government is indirect as it should transmit and amplify the forces of the Diamond Model via demand stimulation, cooperative projects or quality rewards. The government should also focus on creating specialized factors within education, infrastructure and research. It should also limit the tied cooperation among industry rivals in order to sustain the domestic rivalry.

Blakely (2001) contributes to the discussion regarding the role of the government with more specific focus on technology. The government needs to have a better knowledge of the technological capacity and create innovation and development departments that meet the needs of current cyberspace age. It can be assumed that Blakely (2001) and Porter (1990b) agrees on the role of the government with the emphasis on forming new regional institutional arrangements. Government should be perceived as a partner among the industry players, which develops new technology resources similar to spatial resources of the manufacturing economy era (Blakely, 2001).

Porter's theory is perceived by some scholars as incomplete because he has not paid attention to culture and cultural dynamics, which leads for example to national stereotypes. O'Shaughnessy (1996) believes that culture influences society and thus, Porter should focus more on the entity of the nation-culture. It is the traditional culture that teaches hard work or respect for authority, not the state or industry (O'Shaughnessy, 1996). Furthermore, history is another relevant factor that should not be missed in the analysis. As an example O'Shaughnessy (1996) highlights past militarism of Japan and Germany that contributed to their industrial development. Overall, O'Shaughnessy (1996) criticises Porter's theory because it suggests that economic development and its inherent issues can be understood and

solved only through economic determinants. According to him, it is a short-sighted view because it omits the potential influence of history, culture and politics.

Last but not least, Sölvell (2015) has proposed three additional elements to Porter's Diamond Model, i.e. attractiveness, innovativeness and competitiveness. It is based on the assumption that the competitive advantage must be dynamic because at the time when industry gains competitiveness, the pressure to upgrade and innovate is weaker. According to Sölvell (2015), attractiveness is related to nation, competitiveness is characterized by the four static drivers of the Diamond Model, and innovativeness arises when the four drivers of the Diamond Model interacts with each other. Only then, the competitive advantage of nations has a long-term and dynamic potential.

2.4 Summary

In this section, the author explained the theoretical framework, which is used in order to analyse the competitive advantage of Japan through IoT sector. The concept of the competitive advantage was explained on the level of the nation. In the increasingly globalized world the competition is rising and thus, nations need to find areas and invest in the factors, which will enhance their economic prosperity (Poter, 1990b; Grant, 1991). The Diamond Model (Porter, 1990a) constitutes of four major attributes i.e.: factor conditions, demand conditions, firm strategy, structure and rivalry, related and supporting industries; that may lead to an explanation of the industry competitiveness. The Diamond Model was chosen strategically as a framework for the analysis because it might provide insights into sectors relevant for the digital era and thus, contribute to the discourse of Japanese industrial competitiveness strengthening its development. Additionally, the author discusses other factors influencing the competitive advantage that has been suggested by other scholars including Porter's critics. These factors are the role of the government, culture and history.

3 Literature Review

In order to analyse the current technological sector and its potential within the economic development of Japan, the author aims to reveal the literature gap. Therefore, this section provides an insight into two respective areas. First, the author explains the economic development of Japan based on prior discussions. Since Japan is acknowledged for its technological leadership that stems from industrial upgrading, the discussion then shifts

towards the role of innovation in Japanese development. In order to make the reader familiar with the topic, a short introduction to the concept of innovation is also included.

3.1 Explaining 'Miraculous' Japan

The economic development of Japan has been a widely discussed topic among scholars (there are about three million results in Google Scholar) because Japan is the country that was able to quickly recover after the World War II and became the first East Asian economic miracle (Ozawa, 2001). The country has undergone economic modernization from the old traditional agrarian economy to a technological one in a single generation (Karan, 2010). Japan enjoyed almost uninterrupted growth from the 1960s until 1990s (Kingston, 2011). Not only the way of the development helped Japan to be associated with "all modern of our times", but it also fostered development of underdeveloped neighbouring East Asian countries of that time (Karan, 2010:1, Hart-Landsberg & Burkett, 1998).

The economic development of Japan and subsequently the neighbouring countries is often explained via the flying geese theory. This theory was already introduced in 1930 by Akamatsu (cited in Ozawa, 2001) who suggests that the economic development cannot be studied without consideration of mutual interactions between advanced (teacher) and backwards nations (learners). In the case of East Asia, Japan is considered as the leading goose (teacher) that other nations followed in the development (Ozawa, 2001; Hart-Landsberg & Burkett, 1998). However, the country was itself following the industrial path of the U.S. that had influenced the state behaviour through its established regional dominance (Haggard, 2004). Learning from the West was an essential aspect of the Japanese strategy (Ozawa, 2001). As Japan was climbing up the developmental stages in terms of advancing its industries, it was shifting the production to countries with lower cost of production. The aim of the policy was to shift from low-value added industries to high-value added with the state support (Ozawa, 2001). Once the industries lost its competitiveness and became disadvantageous, Japan moved them to neighbouring countries and focused itself on highly competitive industries domestically. Thus the domestic output and export prevailed over import.

According to Ozawa (2001), the economic development of Japan can be divided into four stages where each of them is characterized by different prevailing industry of that time, yet the industries overlapped. In the early post-war period between the 1950s and 1960s *(first*

stage), Japan focused on export-oriented growth through light manufacturing (textile and electronic appliances sector) (Hart-Landsberg & Burkett, 1998). Technological know-how was adapted from the West in order to 'catch-up' within the development (Takada 1999; Karan, 2010). In 1968, Japan was the third largest economy after the U.S. and Soviet Union (Kingston, 2011). However, the rise of wages and trade frictions caused the lack of international competitiveness of the light-industrial products (Hart-Landsberg & Burkett, 1998). The production was shifted to neighbouring countries in order to decrease the cost of the production. The domestic production was therefore changed from light to heavy manufacturing and chemicals *(second stage)*, which was dependent on the import of raw materials (Ozawa, 2001; Hart-Landsberg & Burkett, 1998). Due to the fact that global trade conditions were changing, Japanese economy was examined during the oil crisis in 1973 (Hart-Landsberg & Burkett, 1998). The economic downturn that was caused by the oil crisis (Ikeda, 2004) pushed Japan to the second restructuring *(third stage)* towards mass production of consumer durables (cars and electronics), which ensured that the country revived export and output growth (Hart-Landsberg & Burkett, 1998). The success of Japan can be assigned to automobile and consumer electronic industries that were supported and directed by the state economic model (Haggard, 2004). Japan was heavily export-oriented, which in combination with its protectionism crated trade tensions with the U.S. (Kingston, 2011; Hart-Landsberg & Burkett, 1998). This resulted in 1985 in exchange rate adjustments pushed by Group Five (G5) including the U.S. in order to balance the trade – known as Plaza Accord (Hart-Landsberg & Burkett, 1998; Ozawa, 2001). Japan had no other choice than to find a way to maintain the growth. In the period of post-industrial Japan *(fourth stage)*, the focus shifted from products to services and thus, the technology and information became important factors of production (Karan, 2010). At the same time, Japan's economic policy revolved around foreign direct investment to its Asian neighbours, 'Keynesian medicine' of money supply (real estate and financial markets) and government expenditure (Ikeda, 2004).

Such development strategy helped Japan and East Asia to be recognized by the World Bank as 'miraculous' (Haggard, 2004; Ozawa, 2001). Nevertheless, due to the weaknesses in financial regulation and corporate governance, the country has been hit by the crisis (Haggard, 2004). The government allied with the private sector in order to gain political power, which was later surpassed by the business power. Since the 1990s, Japanese economy has recorded poor performance, which was not caused by the 'catch-up' model of industrial upgrading but rather by the series of macroeconomic shocks (Blomström, Gangnes and La

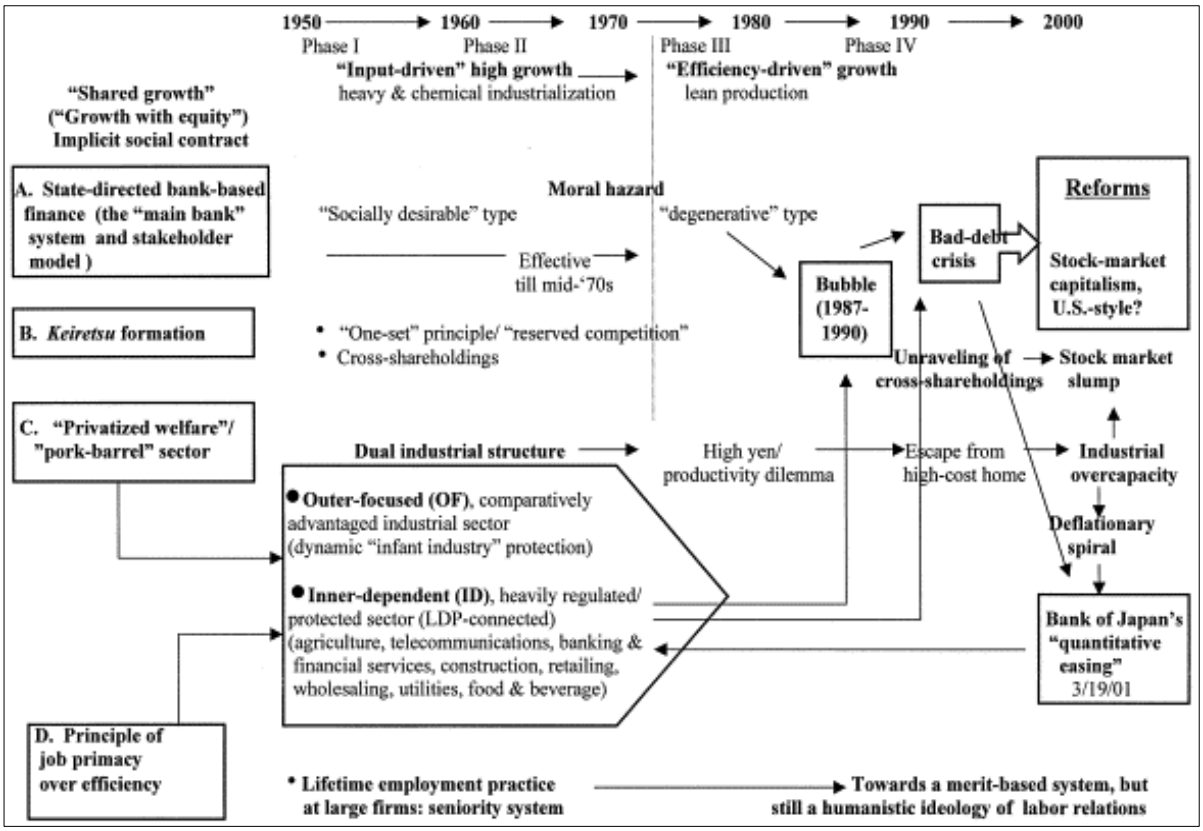
Croix, 2001). This is another reason why the development of Japan is among the most popular topics as scholars have various opinions on what caused the Japanese miracle as well as the debacle. One common stance revolves around the role of the state in the Japanese development.

Structural-institutionalist scholars are among the ones that emphasize the importance of state interventions in order to explain the market success (Hart-Landsberg & Burkett, 1998). Chalmers Johnson, as one of the major advocates of the success of state interventions, defined Japan as growth-oriented developmental state where the economic growth was promoted via governmental institutions that enforced growth-oriented economic policies (Karan, 2010). He is a believer in the positive role of the industrial policy on Japanese growth (Haggard, 2004). On the contrary, this view is not shared by Ozawa (2001) and Hart-Landsberg and Burkett (1998). These scholars criticize the flying geese theory because it omits the directive role of the institutions (especially the financial aspect), which they believed that deepened the economic struggle of Japan.

According to Ozawa (2001), there are four institutional elements that caused both miracle and debacle of the Japanese economy. First, the state-based bank system was responsible for keeping interest rates low, controlling the marketing competition and the flow of capital to selected sectors and projects. The banks were promoting bank loans and thus supporting high-risk investments. Second, the keiretsu system created ties between big corporations and the banks that were closely tied with the government. The business environment has been defined as iron triangle, which refers to collaboration between the state and corporations through intensive bureaucracy (Preston, 2000). The Ministry of International Trade and Industry (hereafter MITI), which controlled and regulated the 'outer-focused' sector consisting of automobiles and electronics also played a role in the development of the Japanese economy (Ozawa, 2001). Third, there was established highly regulated and protected dualistic industrialization. The less efficient 'inner-dependent' sector characterized by agriculture, services and manufacturing, was in the centre of the state attention through the rest of Ministries. Due to the state interventions aligned with the ruling Liberal Democratic Party in Japan that led to corruption, the sector is known as 'pork-barrel' sector (Ozawa, 2001; Haggard, 2004). Moreover, restriction of imports via fixing exchange rate while heavily exporting to other countries supported growth but later caused the trade surplus and subsequently tensions between the U.S and Japan (Ozawa, 2001; Haggard, 2004; Hart-

Landsberg & Burkett, 1998). Lastly, the managerial system in Japan that is based on cooperation and loyalty to groups and subordinates has made managers risk-averse and indecisive due to their obligations. Ozawa (2001) suggests that these four aspects are responsible for creating Japan's advantage but it also later resulted in its biggest disadvantage. The relations between development strategy and actions from state and businesses, and how it lead to crisis is portrayed in Figure 4 below.

Figure 4. Flying geese development of Japan including the institutional elements



Source: Ozawa (2001)

Additionally, Ikeda's (2004) thoughts about the causes of the Japanese debacle are somewhat aligned with the ones from Ozawa. He argues that financial sector, industrial sector and the Japanese government are responsible for the misguided policies that lead to over capacity, insolvent loans and decrease of consumer demand. Nevertheless, he emphasizes that neoliberal ideology was the product enforced by the U.S and its international agencies such as International Monetary Fund and World Trade Organization. Therefore, the U.S. is perceived as a hegemon that rules the global economic system including Japan. Japan was dependent on the U.S. through capital and technology transfer (Ozawa, 2001; Ikeda, 2004).

On the other hand, the mix of foreign technology and domestic innovation lead to Japan's industrial strength (Takada, 1999) and it could hardly be imagined that the country would be able to develop so rapidly without it (Haggard, 2004). The U.S. was always the pioneer in bringing new technology and paradigm but Japan was able to transform it into new popular products (Karan, 2010).

3.2 Development through Innovation

Introduction to Innovation

Innovation is defined as an implementation of new combinations of existing resources. According to Schumpeter, it is about creating or coming up with new products, new technologies, new organization structures or new markets (Makino, 1987; cited in Herbig, 1995). Porter (1990a) considers innovation as a fundamental source of the competitive advantage because it allows being ahead of rivals that do not respond to a change. If companies and nations foster innovation, it is likely that they will be able to survive in a highly competitive international environmental (Herbig, 1995). Therefore, innovation is supposed to be a catalyst for growth (Herbig, 1995). However, innovation needs a special environment. According to Jorde and Teece (1990; cited in Herbig, 1995), the prerequisites for innovation to occur are as follows:

- Labour force with technological skills;
- Economic structures allowing autonomy and entrepreneurship;
- Economic system that encourages new technological approaches and market opportunities;
- Easy access to venture capital;
- Connection between scientific and technological community,
- Good communication between users and developers of the technology;
- Strong protection of IP rights;
- Strategies and structures of firms to capture return on investment (ROI).

Innovation in Japan

When it comes to discussion regarding the innovation in Japan, it revolves around technology because it has a respective place in the development of the country. According to Goto and Odagiri (1997), technology was a major source of the success of the high-technology firms in Japan. Already in 1956, there was established Science and Technology Agency that was controlled by MITI (Karan, 2010). Karan (2005) argues that by the mid-1980s, Japan caught

up to the U.S. in terms of technology level. The major changes were done in the production of cars and audio-visuals, which increased the productivity that helped Japan to deal with several crises (Karan, 2010). The source of the increased productivity and improved quality was intensive R&D[5] spending throughout the 1970s and 1980s and involvement of technology from the West (Goto and Odagiri, 1997). However, Japanese way of innovation is considered to be incremental rather than radical that would disrupt the industries (Goto and Odagiri, 1997). Porter (1990a) argues that one of the reasons of Japan being successful in industrial development is that the determinants of the competitive advantage (factor conditions, demand conditions, firm strategy, structure and rivalry, related and supporting industries) worked well as a system in certain targeted industries. As it was mentioned earlier, several scholars (such as Porter and Ozawa) agree that the state focused only on the development in certain industries and thus, other industries failed. In the time of economic crisis, the mixture of inadequate political responses and failure of producing radical innovation revealed in the 1990s that the system in Japan is unable to cope and support innovation in other areas and small firms (Porter, 2000 cited in Ibata-Arens, 2005).

Yet, Porter (1990a) provides another view on the success of Japan through his theoretical model of competitive advantage. He defined the industries with the competitive advantage based on the share of the world export in 1985. Among the top industries were electronics products, heavy equipment, and steel and transportation (Porter, 1990a).

In terms of factor conditions, Japan had to deal with several disadvantages such as lack of natural resources and limited capital after the World War II (Porter, 1990a). On the contrary, the most significant strength of Japan was human resources (Porter, 1990a). Japan put an emphasis on science and math in education, which helped the country to have literate, educated, highly skilled as well as disciplined and hard-working people. Companies also focused on training to develop specific skills relevant to the industry. The domestic rivalry was enhanced because companies shared their economic information, which enabled them to constantly measure against their competitors. However, none of these factors contributed to innovation as much as issues that Japan had to deal with. For instance, automation of the production happened due to rising wages and lifetime employment, which made the cost of

[5] From 1971 to 1987, the spending in R&D rose by 0,9% to 2.8% whereas 80% of all R&D spending went to general science and technology (Porter, 1990a).

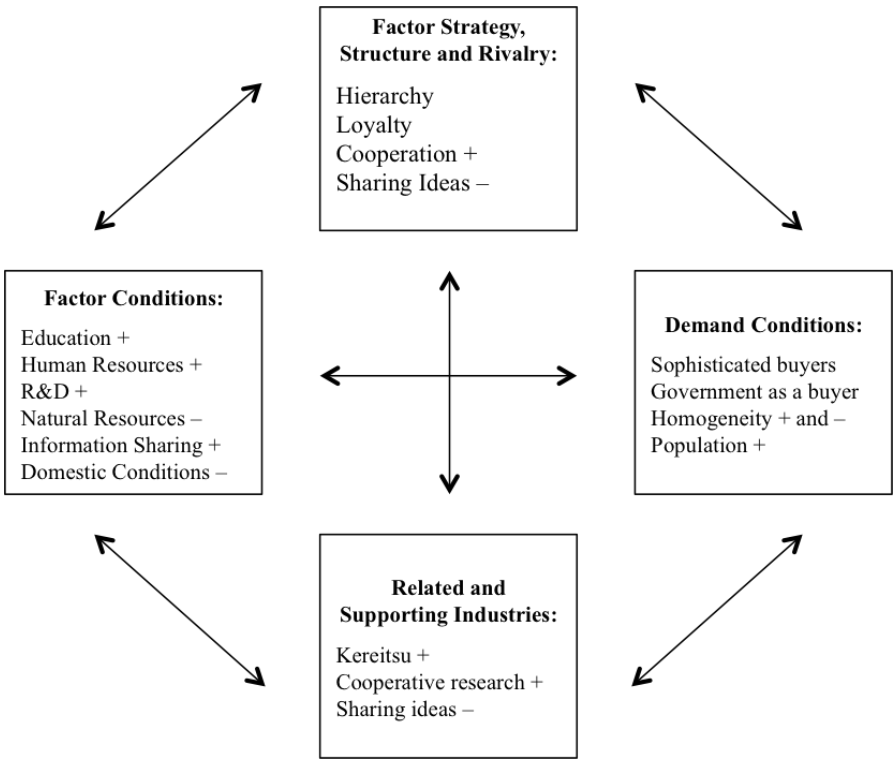
production high. Also, innovations in logistics such as Just-In-Time were stimulated by the geography of Japan (remote island with limited land for additional space for storage) (Porter, 1990a).

Thanks to the fact that Japan is one of the most populated countries, the domestic demand was another engine for innovation (Porter, 1990a). The domestic buyers were sophisticated and required high quality products; hence they were eager to buy domestic electronics, which also signified their status. Homogeneity of the market helped the companies further in terms of purchasing power but made other industries such as furniture or food incapable to penetrate to international markets (Porter, 1990a).

Successful Japanese industries were characterized by cooperative long-term relationships within clusters. The suppliers have been located in close proximity, which made it easy to share information. Hence, new industries grew out from the existing ones such as semiconductors from consumer electronics and cameras. Regarding the companies themselves, Porter (1990a) defined their structures as hierarchical, disciplined, loyal within cooperation and with skilled engineers at the top. This reflects the emphasis on human resources as factor conditions.

On the other hand, Porter (1990a) argues that the cooperative research directed by MITI was focused on private research, which did not benefit the cluster participants. This also enhances the domestic competition because companies did not want to share their best ideas. MITI further stimulated the industry development by introducing standards. The role of the government is evident even from Porter's (1990a) work in which he emphasizes that the government was not only the regulator but also the buyer in some industries.

Figure 5. The Diamond Model facilitating the competitive advantage of Japan according to Porter



Source: own

Innovation Opportunity in Post-industrial Era

For the purpose of this research, it is important to look more closely into the post-industrial era that is characterized by the shift from products to services and where technology and information is one of the most important factors of production (Karan, 2010). Despite innovation and competitive advantage achievement in technology, Japan is once again on the path of 'catching up' due to its economic slowdown (Karan, 2010). Sectors such as IT lag behind the U.S. because of high telecommunication cost, weak infrastructure in terms of capacity and speed, and business regulations and old-fashioned business practices (Karan, 2010). Yet, there are other new industries such as IoT that open doors for new opportunity how to become competitive again. As argued by Kodama and Shibata (2017:17), IoT can bring a "fundamental change in technology development [...and] lead us into the highly sophisticated techno-society". Japan has relatively good position because of its technological legacy and sophisticated buyers. However, up until today, the research analysing potential competitiveness of the IoT industry in Japan is limited to distinct engineering subjects. Hence, the author aims at filling the literature gap between two research phenomena related to Japan i.e. economic development and innovation.

3.3 Summary

This section discussed the economic development of Japan and what was behind the success until the 1990s. Overall, the advantage of Japan was the 'catch-up' industrialization model oriented towards growth via export. Japanese government had directive role in order to stimulate the industrial development (Ozawa, 2010; Ikeda, 2004). However, due to the established structures, the state interfered into the development with inappropriate fiscal and monetary policies (Miyagawa, 2010), which has represented obstacles for Japanese economy to recover from the crisis. After enlightening existing discussions regarding the economic development in Japan, the author shifted to another angle concerning innovation and competitive advantage of top performing industries in Japan. This provides a good basis for understanding how innovation in Japan was analysed. Based on Porter's (1990a) findings, Japan created the competitive advantage mainly through human resources, domestic rivalry and demand pressures. This contributed to enhancing innovation together with several disadvantages such as limited land and distance from other countries. However, Porter (1990a) also agreed on the influence of the government. Finally, it was emphasized that Japan is losing the position in current significant sectors such as IT despite the existence of relevant preconditions for gaining competitive advantage there. Therefore, there is room for analysing how competitive Japan can be in the sector that is vital for 'surviving' in technology development on the global scale.

4 Methodology

This section presents the methodological choices that enable to conduct the research in an efficient and structured manner. The author provides an overview of what research approach and strategy was chosen in order to answer the research question. It further includes the discussion regarding the data collection as well as ethical considerations.

4.1 Exploratory Research with Mixed Methods Strategy

The research required for this thesis is guided by the research question: *Does Japan have a competitive advantage in the IoT sector that could potentially strengthen its development in the current digital era?* First, the author reviewed the existing literature in order to understand the research phenomenon regarding the competitive advantage of Japan. After that, the data collection was conducted, which helped to gain new insights and provide a

relevant analysis of the competitive advantage of specific industry in Japan. Through this open and curious approach, the research can be characterized as exploratory study (Saunders, Lewis & Thornhill, 2009).

In order to complete this exploratory study, a mixed methods research strategy was selected as the most suitable for various reasons. The major distinction between mono method and mixed methods strategy is that it entails both qualitative and quantitative research strategies in a single study (Bryman, 2012). Quantitative research is concerned with numbers while qualitative research is concerned with words and requires thick descriptions (Bryman, 2012). In this research, the quantitative research is conducted via descriptive statistics. The author collected various qualitative data from statistical portals such as OECD, Statista and Statistics Bureau in order to investigate and assess several components of the Diamond Model. The qualitative part of the research was conducted via primary sources such as governmental documents and strategies accessed on official websites of various Ministries and organizations in Japan. Moreover, it further included the data collection from the websites of the companies. The content analysis served as an appropriate research method for these qualitative data because it allowed exploring the patterns through identified themes. For example, the themes included words such as 'IoT', 'Smart', 'ICT', 'partnership' or 'cooperation', which were further interpreted in the analysis. Despite involving qualitative research, the content analysis compensated its limitations by being regarded as systematic and analytical, yet flexible method (Bryman & Bell, 2015). All qualitative and quantitative data that were collected result in a single dataset (Flick, 2011) and thus, it enabled to investigate all microeconomic drivers of the competitive advantage as some of them required understanding of statistical data and others required understanding of the substance of the documents. This has resulted in an alignment with Bryman (2012) who argues that mixed methods research is not made of separate components but the components should relate to each other.

By choosing the mixed methods strategy, the author was able to gain a deeper understanding of the research phenomenon because the limitations of mono method were avoided. Additionally, the mixed methods research has balanced weaknesses and strengths of qualitative and quantitative research (Bryman, 2012). For instance, the collection of statistical data provided reliable hard data, which allows the research to be reliable because replicability is one of the weaknesses of the qualitative research as interpretations of data can vary from

researcher to researcher (Bryman, 2012). On the contrary, the findings from the content analysis of the strategic documents (from both the government and selected companies) allowed revealing rich and deep data. Therefore, it lead to the revelation whether there is a correlation or misunderstanding between both data sets, which enhance what Bryman (2012) calls the completeness of the research area. The data discrepancy is what makes the mixed methods research challenging, which was partially the case of this specific research.

4.2 Data Collection

The collection of the data was rather challenging. Firstly, the author had to rely on sources in English due to language barriers. For instance, the international statistical portals do not always provide the latest data because they are extracted from the original sources. Secondly, it is important to note that the data was primarily collected for a different purpose than this research and thus, the data could have been presented in a biased way in order to create a specific wanted image. However, the author itself acknowledges this limitation. In order to increase the trustworthiness of this research, only reputable sources were selected in the data collection process.

Additionally, by applying both international as well as Japanese sources, the author aimed at balancing the limitation of the data. For instance, the data from international statistical portals reveals the gaps between the data that was extracted from documents produced by Japanese entities. The author tried to be transparent by listing all sources that were involved in the research below in Table 1.

Table 1. List of data collected for this research purpose

Data	**Source**	**Rationale**
Content		
White Paper on International Economy and Trade 2017	Ministry of Economy, Trade and Industry (Japanese)	The latest document
Smart Japan ICT Strategy 2014	Ministry of Internal Affairs and Communications (Japanese)	The document addressing ICT sector with the strategy towards 2020
Industrial Cluster Project	Ministry of Economy, Trade and Industry (Japanese)	Analysis-related document
Knowledge Cluster Initiative	Ministry of Education, Culture, Sports, Science and Technology (Japanese)	
Government and Prime Minister website	Public (Japanese)	Supportive information
Company websites	Private (Japanese)	Major source for one of the microeconomic drivers/publicly accessible data
Japan External Trade Organization	Government-related (Japanese)	Supportive information

Japan Innovation Network Innovation Network Corporation of Japan	Public-private (Japanese)	Analysis-related document
Statistics		
Statistics Bureau	Ministry of Internal Affairs and Communications (Japanese)	Major source to enter recent statistics
JAOS Surveys	Japan Association of Overseas Studies (Japanese, general incorporated association)	
OECD Data	Organisation for Economic Co-operation and Development (global, intergovernmental)	
Statista	Online statistics portal (private, German)	
Statistical Abstract 2016 edition	Ministry of Economy, Trade and Industry (Japanese)	
World Economic Forum	Independent international organization	Supportive information

Source: own

Last but not least, the author chose to collect data on both the ICT and IoT sector because searching for data related to IoT would only result in limited data sets, as the sector is relatively new. However, the IoT sector is based on ICT (Information Technology Industry Council, 2018) and thus, focusing on both of them does not limit or contradict the research.

4.3 Ethical Considerations

This research does not involve any method that would require considering wider ethical principles such as in the case of conducting interviews or ethnographic observations (Bryman, 2012). This would for instance involve informing the respondents about the background of the research, gaining the consent from the respondents and guaranteeing them the anonymity (Bryman, 2012). However, the researcher does not deal with any sensitive information or material (collecting data directly from government representatives or conducting research in Japanese companies) because all necessary data are publicly accessible via Internet. This could be somewhat limiting to the research as such primary data could bring additional valuable insights. Nevertheless, the author assessed that it would be unrealistic to penetrate into Japanese Ministries or companies, especially because the latter secures internal information regarding the future strategic direction as it could affect their market position in the highly competitive era. Therefore, ethical considerations related to this research are addressed via netiquette - a term that refers to etiquette within the Internet search (Bryman, 2012). Nevertheless, it is assumed that all the data that are published online by the respective sources are open to be accessed by anyone at anytime.

5 Analysis

This section reveals the empirical findings of the research. The author attempts to analyse the ICT/IoT sector through several indicators based on Porter's Diamond Model. The competitive advantage of Japan in the ICT/IoT sector is explained through the model. Furthermore, the discussions involve the comparison of the current state of the competitive advantage with the competitive advantage of the country when it was experiencing an economic boom, as well as the role of the government.

5.1 Firm Strategy, Structure and Rivalry

The first microeconomic driver is concerned with the firms of the specific industry. Porter (1990b) involves analysis of the management practices, organizational models, goals of firms as well as rivalry on the market. However, the investigation of firms operating within the ICT/IoT sector is limited to information that is publicly accessible and does not involve discussion about management practices and organizational structures.

It is clear that corporations in Japan have a significant place in its development as they largely contribute to GDP. This is shown through the corporate investment that has recorded significant linear growth since the 1990s (OECD, 2016). In 2016, it reached 69.2% of GFCF (gross fixed capital formation) while general government investment is continuously declining during the same period with the total amount of 15.5% of GFCF in 2016 (OECD, 2016).

In relation to the ICT sector, JETRO (2015) provides information on what are the top ICT companies in Japan. It includes multinational conglomerates with a long history in Japanese economy such as Toshiba, Fujitsu, Hitachi, Panasonic, NEC, Sony, NTT, Softbank, and Rakuten. Fundamental information about these companies is summarized for an overview in Table 2.

Table 2. Leading ICT companies in Japan

Company	Founded	Financial Situation	Employees	Products & Services related to ICT and IoT	Slogan/ Mission	Strategy
Toshiba	1875	Net sales: 4,870.8 billion Yen (As of March 31, 2017)	153 492	ICT equipment and systems, digital solutions, industrial IoT solutions	Leading innovation	"Co-creating New Businesses with Customers by Concentrating the Comprehensive Strength of the Toshiba Group" (Toshiba, 2018:n.p.)
Fujitsu	1935	Revenue: 4,509.6 billion Yen (As of March 31, 2017)	155 000	Technology products, solutions and services in ICT, UBIQUITOUS WARE IoT Solutions	Human-centric innovation, Co-creation for success	"Fujitsu aims to create an environment to support innovation on a proven IoT platform, powering digital transformation with IoT solutions and services for the transformative enterprise." (Fujitsu, 2017:3)
Hitachi	1910	Net sales: 1,930.3 billion Yen (As of March 31, 2018)	303 887	IT systems for various sectors (for instance healthcare, automobile) Industrial IoT, Energy IoT, Smart Cities, IoT Analytics	Inspire the Next	Focus on social innovation business. "Hitachi aims to become An Innovation Partner for the IoT Era." (Hitachi, 2018:n.p.)
Panasonic	1918	Net sales: 7,343.7 billion Yen (2016)	257 533	Business to business - Smart factory solutions, IoT/Robotics - AI robotics home appliances, autonomous driving/commute, stores and service solutions, next-generation logistic and transportation	A Better Life, A Better World	"Leverage the strengths that [...] Panasonic have long developed in [their] consumer electronics business, and the strengths of [the] business partners who have in-depth expertise in various spaces, and will work to combine these strengths by pursuing "Cross-Value Innovation."" (Panasonic, 2018:n.p.)
NEC	1899	Consolidated net sales: 2,665.0 billion Yen (As of March 31 2017)	107 729	IT solutions in manufacturing, retail and services, and finance in the private sector, IoT platforms based on ICT	Orchestrating a brighter world via solutions for society	Co-creating the future through digital transformation.
Sony	1946	Consolidated sales and operating revenue: 7,603.3 billion Yen (As of	128 400	Factory automation, IoT including drones, automotive applications, AI and robotics,	Be moved	Innovation in Sony's DNA. "Realizing new potential through creative technologies, products and services and a spirit of innovation that focuses on contributing to society."

		March 31 2017)		connected devices - consumer electronics		"Partnership with a diverse array of stakeholders." (Sony, 2018:n.p.)
NTT	1985	Consolidated Operating Revenues: 11,391 billion Yen As of March 31 2017)	274 850	B2B2X businesses - AI, IoT, Big Data	Value Partner, Transform. Transcend.	"Advancing [the] transformation while at the same time taking advantage of digitization, the IoT, AI, and other social and technological developments." (NTT, 2018:n.p.)
SoftBank	1981	8,901.0 billion Yen (2016)	68 402	Robotics, ICT services, AI, IoT,	Information Revolution — Happiness for everyone. Shake up the world.	"Drive the Information Revolution forward and usher in the IoT era as quickly as possible to realize a world where all manner of things on the planet will be connected." (Softbank, 2018:n.p.)
Rakuten	1997	Revenue: 944 474 million Yen (As of December 31 2017)	14 845	Smart Business	"Global Innovation Company: Empowering people to realize their dreams" (Rakuten, 2018:n.p.)	Triple-S Strategy: Strong, Smart and Speed (Rakuten.Today, 2016)

Sources: Toshiba (2018), Fujitsu (2018; 2017), Hitachi (2018), Panasonic (2018), NEC (2018), Sony (2018), NTT (2018), SoftBank (2018), Rakuten (2018), Rakuten.Today (2016)

After collecting the data about the strategy and businesses of the selected companies, it can be concluded that they all share the need of placing innovation in the core of their strategy. They all include IoT and ICT products and services in their portfolio. Therefore it can be understood that the companies realize that the IoT and ICT sector is vital for driving their competitive advantage for the future. Moreover, there is a shared goal to contribute to society with their IoT and ICT products and services. This feeds into the idea that information and communication technologies powered by Internet can contribute to improve the socio-economic development (Myers, 2016). In terms of rivalry, it is obvious that all these companies compete for their market share. However, there were found themes in their strategies, such as 'co-creation' and 'partnership' that suggests that the top ICT firms are ready to unify their capabilities to enhance the competitive advantage of the nation as a whole. This also indicates that the legacy of the keiretsu system might be prevalent. It will be up to the firms whether they will turn it into a benefit while sharing information and ideas or into a burden when new smaller companies will not be able to enter the industry or there will be high switching cost for suppliers.

When it comes to analysing ties between the listed companies as well as the Japanese government, it can be assumed that there are prevailing strong ties that were created in the past. Despite the difficulties in investigating which keiretsu the companies belong to, it is clear that most of them are part of the networks constituting of banks, shareholders and other business partners in order to create a favourable market conditions (Gerlach, 1992). For instance, it can be seen from the report of Mitsui (one of the keiretsu) that Toshiba and Fujitsu belong to this network because the two external directors of Mitsui hold positions at Toshiba and Fujitsu (Mitsui & Co., Ltd., 2015). Moreover, the ties between the government can be assumed through the fact that the companies have a strong dominance in Japan through their financial results and therefore, they contribute largely to the economy. Therefore, their level of competitiveness can define the competitiveness of the nation, which further projects into economic prosperity. Last but not least, the ICT companies can easily obtain finances from the banks due to their willingness to lend the money while paying low interest rates (Atradius Collections, 2017). This is similar to the situation when Japanese economy has started to slow down. At that time, the interest rates were kept on low level and the state-bank system was supporting the loans (Ozawa, 2001). Nevertheless, this could negatively influence the economic development as it is recognized by Ozawa (2001) as one of the major reasons of the economic decline in Japan.

Additionally, the data in Table 3 shows that the environment in Japan is not supportive of new local businesses with 'scarce resources' for innovation such as organizational agility, promising ideas or willingness to take risks (Weiblen & Chesbrough, 2015). In comparison to other leading economic nations such as Canada (11.3%) and the U.S. (9.4%), the startup rate in Japan is significantly lower at 3.2% (Statista, 2018c). According to the latest available data, Japan ranks lowest in terms of the number of business startups in 2017 - only 4.7% of the total population is involved in business startups (Statista, 2018d). This can be due to the difficulties of companies with assessing training and capital where Japan ranks also among the lowest countries (OECD, 2018a). For instance, the U.S. and Germany as the 'old-time' rivals are significantly ahead of Japan. This is aligned with the fact that Japan does not have its own 'Silicon Valley' that would allow new startups to evolve and scale (Lucas, 2017). Another data set shows that Japanese ICT corporations such as Panasonic, SoftBank and Sony invest and buy-out foreign startups (Inagaki, 2018). According to Inagaki (2018),

corporate venture capital[6] spending was at the record high with 70.9 billion Yen in 2017. In 2011, it was at 1.2 billion Yen. This further underlines the role of firms in the competitiveness of Japan.

Table 3. Startups in Japan

Firms	Data	Comments and comparisons	Source
Starting a business	4.7% of total population and 3.2% startup rate in 2017	Japan is the last country in the ranking between Asia and Oceania, and 8% and 6% behind Canada and the U.S. in startup rate.	Statista
Access to training, men	31% in 2013	Japan is 7th worst country in terms of enabling to start a new business. Germany and the U.S. is way ahead of Japan in all four indicators as.	OECD
Access to training, women	17% in 2013		OECD
Access to finance, men	34% in 2013		OECD
Access to finance, women	22% in 2013		OECD

Source: OECD (2018a), Statista (2018c; 2018d)

5.2 Factor Conditions

Table 4 includes major relevant factor conditions of Japan that are related to the ICT/IoT sector. This allows analysing the factors of production, such as education focusing on technology (Porter, 1990a; Blakely; 2001) that are necessary in order to create competitive advantage. In comparison to Porter's analysis on Japan's competitive advantage in the 1970s, the education that is required to maintain skilled labour force in technology does not seem to improve today. This is due to the decreasing amount of students attending and graduating from the college of technology. According to Ministry of Education, Culture, Sports, Science and Technology (hereafter MEXT) (2016), there were around 57 000 students attending the college in 2013 which is 3% less than the highest amount that was recorded in 2011. However, the most significant increase of technology students from national, private and local colleges was recorded in the 1970s. This corresponds with the time when Japan achieved the economic success due to its technology leadership in various sectors. Since then, the rate of students that are interested in studying technology is relatively steady with slight increase in the 1990s. The decreasing rate of technology students is aligned with the decreasing amount of new graduates. If less students attend the college, the less students will graduate. In 2015, 9 811 students graduated from the technology college, which was 5% less than in the previous year (MEXT, 2016). Additionally, the amount of Japanese students

[6] Venture capital is an engagement in entrepreneurial activity via investment (Weiblen & Chesbrough, 2015)

studying abroad is increasing (JAOS, 2016; 2017), nevertheless, the statistic suggests that most of these students (69%) go abroad in order to improve their language skills (JAOS, 2017).

On the contrary, Japan seems to still maintain good level of performance in math and science, which was earlier one of the factors that contributed to the strength of human resources in Japan (Porter, 1990a). According to OECD (2018b; 2018c), Japan is significantly above OECD average in both areas. This might project into employment in technology sectors such as ICT, which is higher than OECD total (2018d). Nevertheless, when comparing the math performance to other countries, it supports the argument that Japan is losing the competitive advantage in the education factor. The leading countries are: China, Singapore, Hong-Kong Taiwan, Korea and Macao. This means that Japan is lagging behind the neighbouring rivals (OECD, 2018e).

Research and development (hereafter R&D) is another factor that was selected as an indicator of the competitiveness in Japan. Despite the fact that Japanese strategy promotes R&D (Ministry of Internal Affairs and Communications (hereafter MIAC), 2014), there is a decreasing trend in R&D spending. Based on the data from OECD (2018f), in 2016, R&D spending in Japan was at 3.1% of GDP. The highest ever R&D expenditure was recorded in 2014 at 3.4% and in 2015 it dropped to 3.3%. The biggest R&D spenders ahead of Japan were Israel, Korea and Sweden in 2016. It is also important to find out where the investment in R&D flows. The ICT sector recorded 11.3% of all R&D spending in 2015 (Statista, 2018e), which is behind other sectors and automobile sector. It can be assumed that the ICT sector continues to be addressed in strategic documents but the current data does not show that the sector is at the top priority list for Japan. It seems that Japan continues to focus on automobile sector, which was one of the sources of the economic success (Haggard, 2004). However, it is important to note that IoT penetrates into other industries such as the car industry through its sub-sectors (in this case connected cars) and thus, it does not necessarily mean that R&D spending in other sectors than IoT and ICT should be considered as inappropriate. In addition to R&D spending, the amount of patents also reveals the current as well as future condition of the IoT sector. In general, the number of patent applications is continuously decreasing in Japan. In 2015, there were 2.2% less patent applications than in 2014. The total number was 318 721 (Statistics Bureau, MIAC, 2017). However, a deeper look into IoT sector shows that the number of patent applications was increasing from 2007

until the latest in 2016. The total number of patent applications in IoT was 1 718 in 2016 (Statista, 2018d). Nevertheless, even with this amount, Japan lags behind its main competitors such as China, the U.S., South Korea and EU (Statista, 2018f).

In summary, it is clear that based on the selected factor conditions such as technology-oriented education and employment, R&D spending and patents application, Japan might not be on the right path of enhancing the competitive advantage in the sectors that are relevant for the Fourth Industrial Revolution. Instead it seems like the Japanese government has a vision of which industries should be supported, but in fact there are other factors that the government should address. For example, the focus should be on education to support skills that are relevant for the digital era in order to have strength in human resources because it is still people that come up with the ideas that can become important inventions. Furthermore, the government should not underinvest R&D in the ICT/IoT sector as it can influence the amount of patent applications. Altogether, it is one of the fundamental elements that could increase the competitiveness.

Table 4. Factors of Production in relation to ICT and IoT in Japan

Factors of Production	**Data**	**Comments and comparisons**	**Source**
Education			
Amount of students (College of technology)	57 611 in 2015	Decreased by 3% from the peak in 2011. The highest increase was recorded in the 1970s. Since then the rate is relatively steady with slight increase in the 1990s.	Ministry of Education, Culture, Sports, Science and Technology
College of technology New Graduates	9 811 in 2015	Decrease of 5% from previous year.	Ministry of Education, Culture, Sports, Science and Technology
Japanese students abroad	79 123 in 2017	43% increase from 2013. 69% of these students studied languages.	JAOS
Mathematics performance (the mean score is the measure)	532 in 2015	Increasing from 2007 until 2012 then stable until 2015, which is ahead of OECD average 490. In comparison to other countries, it is behind China, Singapore, Hong Kong, Taiwan, Korea and Macao (2012).	OECD
Science performance (the mean score is the measure)	538 in 2015	Increasing from 2006 until 2012 and then declining in 2015. This is ahead of OECD average 493.	OECD
R&D			
R&D Spending	3.1% in 2016	Decreasing from record high 3.4% of GDP in 2014, 3.3% in 2015. The biggest spenders in 2016: Israel, Korea and Sweden.	OECD
Share of R&D to ICT sector	11.3% in 2015	Behind automobile sector and other sectors.	Statista

Employment in ICT	4.7% in 2011	1% more than OECD total.	OECD
Patent Applications (overall)	318 721 in 2015	2.2% less than in 2014. Gradual drop since 2006 with significant drop in 2009.	Statistics Bureau, Ministry of Internal Affairs and Communications
Number of IoT patent applications	Increasing from 2007 until 2016 to 1 718	Lagging behind China, USA, South Korea and EU.	Statista

Sources: MEXT (2016), OECD (2018b; 2018c; 2018d; 2018e; 2018f), JAOS (2016; 2017) MIAC (2014; 2017), Statista (2018e; 2018f)

5.3 Demand Conditions

According to Porter (1990a), demand conditions are characterized by the demand from the buyers that are willing to buy the product or service of the given industry. Nevertheless, it also depends on the local market conditions. Therefore, looking at the population in Japan, it is one of the most populated countries, which could mean potentially big market demand. However, Japan is currently dealing with a demographic crisis (Kingston, 2011) because of its shrinking population. The projections does not seem positive because according to Statista (2018g), the declining trend in the number of people should continue up until 2022. If there are less people, the market opportunity for domestic industry is shrinking too. This is further enhanced by other factor such as household expenditure. According to Statistics Bureau (MIAC, 2017), Japanese households were spending less in three consecutive years from 2013 until 2016.

However, looking at the demand and spending in the IoT sector, the researcher chose two representative sub-sectors such as Smart Homes and Connected Cars. The revenue of smart appliances that are defined as devices that are directly or indirectly controllable by Internet at homes was at 557.9 million USD in 2017 (Statista, 2018h). This is 61% increase from the previous year and it is further expected to grow annually by 30% on average until 2022. This growing trend is recorded also in Connected Cars sub-sector with the revenue of 1 174 million USD in 2017 (Statista, 2018i). There the annual growth is forecasted to be slower at 13% of annual rate between 2018 and 2022. Moreover, the revenue of the whole IoT sector was at 129.25 billion USD in 2017 (Statista, 2018j). It reflects the growing trend of the sub-sectors. In 2020, the overall revenue of the IoT sector is expected to amount to 175.92 billion USD. Moreover, there should be 1 057 million IoT devices in use by 2020, which is 36% increase from 2017 (Statista, 2018k). All these data depicted in Table 5 shows that there is

the demand for IoT and this demand should grow further. This explains and supports that fact that Japanese consumers are sophisticated, as they are demanding the latest goods and services that can provide better solutions in their daily lives. As IoT belongs to high technology products, the sector might benefit from the strong technological legacy of the nation and the associated purchasing power in Japan (Porter, 1990a).

Even though there are positive forecasts in terms of demand of IoT, the growth of revenue in respective indicators in Japan is not exceeding the growth in countries such as China and the U.S. This also signifies that international competition is strong in IoT and that Japan is lagging behind its economic rivals. This is also acknowledged by the Japanese government in the White Paper from the Ministry of Economy, Trade and Industry (hereafter METI) (2017). There are named major global companies such as Google and Amazon originating from the U.S. Therefore, it can be assumed that the Japanese government considers these IT companies as global leaders that foster competitive advantage of their nation because they "actively expand in the field of the Fourth Industrial Revolution" (METI, 2017:652). This might leads us to a conclusion that Japan is once again in the 'catch-up' phrase of the development in the digital era.

Table 5. Demand Conditions in relation to IoT in Japan

Demand Conditions	**Data**	**Comments and comparisons**	**Source**
Population	126.96 million in 2016	Declining trend continuing until 2022 based on the forecast.	Statista
Households Expenditure		Decreasing in three consecutive years until 2016.	Statistics Bureau, Ministry of Internal Affairs and Communications
Smart Appliances Demand in Smart Homes Segment			
Revenue	557.9 million USD in 2017	This is 61% increase from the previous year. By 2022, it should rise to 884.2 million USD. It is behind the U.S. and China.	Statista
Connected Cars			
Revenue	1 174 million USD in 2017	Increased by 20% from 2016. Expected to grow by 13% annually from 2018 until 2022. Behind the U.S., China, Germany and UK.	Statista
Installed base of IoT	777 million units in use in 2017	In 2020 it should amount to 1 057 million - growing trend.	Statista
Revenue of IoT	129.25 billion USD in 2017	In 2020 it should amount to 175.92 billion USD - growing trend.	Statista

Sources: Statista (2018g, 2018h, 2018i, 2018j, 2018k), MIAC (2017)

5.2 Clusters

The analysis of clusters related to the ICT and IoT sector respectively is conducted through collection of information from governmental documents because activities and projects related to clusters are established and coordinated centrally by METI and MEXT (EU-Japan Centre for Industrial Cooperation, 2018). The main objective of clusters is to establish cooperation and relationship between industry players in order to foster innovation through sharing information (Porter, 1990a). Japan seems to have a clear cluster strategy defined by earlier mentioned Ministries. However, in comparison to EU cluster strategy that is based on managing and supporting cooperation between companies, universities and R&D centres, Japanese structure of the clusters is intensively characterized by R&D centres that place R&D projects in the centre of the innovation. There are involved private companies, universities and other public entities but their cooperation is defined by specific R&D projects relying on public funds (EU-Japan Centre for Industrial Cooperation, 2018). When the projects are completed, they should serve as a source of knowledge for the industry.

Japan Innovation Network (hereafter JIN) is an example of the cluster that is based on close ties between corporations, government and industry. It was established in 2013 by METI and it helps large companies to innovate (JIN, 2018). Some of the previously mentioned ICT firms are part of the network, i.e. Sony, Hitachi, NTT, Panasonic and NEC. In parallel, METI supports similar network - Innovation Network Corporation of Japan (hereafter INCJ) - that was launched in 2009 as a public-private investment fund (INCJ, 2018). According to World Economic Forum (2016), the major financial sources come from the government, which contributed 142 billion Yen (2009-2016) and corporations including Hitachi, Panasonic, Toshiba, Sony or Sumitomo (keiretsu) providing 14 billion Yen. Moreover, among other partners are also banks such as Development Bank of Japan and The Bank of Tokyo (INCJ, 2018). This partnership supports the argument that the industry in Japan is still affected by the 'Japan.Inc' system because the networks are managed by the people that previously held positions in government institutions as well as corporations[7].

[7] Akio Mimura is currently the chairman of INCJ. Between 1963 and 2003 he held several top positions in Nippon Steel Corp and from 2013 he has been a chairperson of the Japan Chamber of Commerce and Industry and the Tokyo Chamber of Commerce and Industry (INCJ, 2018).

Additionally, METI (2009) has developed a cluster policy known as *Industrial Cluster Project (2001-2020)* that is divided into three phases: 1) launching 20 cluster projects (2001-2005); 2) fostering network information and developing specific businesses (2006-2010); and 3) continuing with the second phase and focusing on achieving financial independence and growth (2011-2020). The policy is led by the local governments and the aim is to enhance industrial competitiveness (METI, 2009). According to information from METI (2009), there are identified 18 industrial cluster projects in various regions. The projects are spread between different sectors including IT but other sectors prevail, such as pharmaceutical. The major regions that were targeted for information technologies are:

- Hokkaido involving 340 companies and 3 universities
- Kansai involving 1200 companies and 60 universities
- Okinawa involving 120 companies and 2 universities
- Kanto targeted for the development of IT Ventures

The second cluster policy *Knowledge Cluster Initiative* was developed and implemented in 2002 by MEXT and serves as a system for technological innovation (MEXT, 2010a). The goal of this initiative is to revitalize local economies through project planning, joint-research and the exchange of ideas between universities and R&D centres. With the budget of 7.5 billion Yen in 2009, there were targeted industries in various regions that are not aligned with the regions targeted by METI. The IT industry is targeted only in one region i.e. Fukuoka Kitakyushu Iizuka and involves cooperation between five universities (MEXT, 2010b).

Moreover, Japan External Trade Organization (hereafter JETRO, 2017) holds another role within the cluster environment in Japan. It developed a mapping tool that provides information about industrial clusters within regions. Sapporo, Iwate, Sendai, Yokohama, Kyoto, Shimane, and Okinawa are the cities focusing on the IT/ICT sector. Specifically, Okinawa is defined as Asia's major 'Smart Hub' (JETRO, 2017), which signifies a strong role in the IoT development.

Overall, it is clear that the Japanese government understands the need of creating and supporting clusters from the very central level. It is also part of Abenomics[8] (The Government of Japan, 2018), which involves the plan of establishing National Strategic Special Zones. There are ten additional areas that correspond with targeted regions by METI and MEXT, and which can benefit from implemented structural reforms that should encourage creation of new industry areas. Nevertheless, none of these areas achieved the global recognition similar to Silicon Valley in the U.S where top technology companies are located. Furthermore, the role of the government is significant. It seems that the situation has not really changed since 1970-1980 when the emphasis was placed on R&D and public-private cooperation (Porter, 1990a). Nowadays, the role is placed on the coordination of various research projects involving cooperation between businesses, universities and R&D centres. In relation to the ICT and IoT sector, there are fewer clusters and fewer R&D projects than in other industries. Therefore, it can lead to undermining of the competitive advantage in this area despite the fact that it is acknowledged in the governmental strategies as an important area for increasing competitiveness in the Fourth Industrial Revolution.

5.5 Role of the Government

The study of the selected Japanese governmental documents reveals how Japan tries to foster the development via the ICT and IoT sector in particular. MIAC and METI seem to have one of the central roles in suggesting strategies for a more technologically competitive Japan. These strategies are aligned with the *Japan Revitalization Strategy* (Prime Minister of Japan and His Cabinet, 2017) outlined by the central government, which corresponds with Abenomics. The three policies aim at creating new regulatory and institutional reforms and reviving technological leadership of Japan through innovation. This should not only strengthen Japanese industry but also tackle demographic issues.

The *White Paper on International Economy and Trade 2017* (METI, 2017) addresses opportunities as well as challenges of the Fourth Industrial Revolution and recognizes IoT as one of the major technological innovations driving the future. It is apparent that the Ministry is prepared to stimulate the private sector by improving and revising rules to enhance

[8] According to Government of Japan (2018), Abenomics is economic policy package introduced in 2013 by the Prime Minister Shinzo Abe to revive Japanese economy after two decades of stagnation. The package includes three pillars: a) monetary policy; b) fiscal policy; and c) structural reforms.

investments in innovation. The White Paper (METI, 2017:653) states that "the government must support [business] activities" and that "public-private strategy intend[s] to enable Japanese companies to survive [the Fourth Industrial] revolution". It is apparent that the role of the Japanese government has not changed from the past. Rather than being a facilitator in the process of innovation for the private sector (as suggested by Porter (1990a), the government still takes a regulatory role. As discussed above, MITI controlled and regulated the major sectors that were targeted by the government to increase productivity between the 1970s and 1980s (Ozawa, 2001; Karan, 2010). Therefore, it had a negative impact on the performance of the economy later on. Nowadays, METI succeeds MITI in setting the industrial strategy (METI, 2018). It is clear from the governmental strategy that the influence of METI on the industry is relatively extensive. Another similarity can be found in the time when Japan introduced the Science and Technology Basic Law in 1995 through which the government outlined the first Basic Plan to promote science and technology policies (Statistics Bureau, MIAC, 2017). Nowadays, the regulation is enforced via the Industrial Structure Committee that was established in 2015 under the Industrial Structure Council (METI, 2017), which studies the changes brought by technological innovations in IoT, big data, robotics and artificial intelligence in order to define the actions for public and private sectors.

The government further addresses the need of competitive advantage in both documents, the *Smart Japan ICT Strategy* (MIAC, 2014) and the White Paper (METI, 2017), which feeds into Porter's (1990a) theory of the same phenomenon. Despite the theory critics from international economic field, even nations recognize the need of creating competitive advantage in specific industries. The *Smart Japan ICT Strategy* (MIAC, 2014) is divided into two major areas; the first is 'ICT Growth Strategy' tackling national competitiveness and the second is 'Initiative on Intensification of International Competitiveness and Global Outreach in the field of ICT' addressing international competitiveness. The two priority projects 'ICT Smart Town' and 'Smart Agriculture' involved in the strategy signify the focus on IoT based on its definition of connected 'smart' devices that communicate with each other. However, in comparison with what Japan did in its 'miraculous' times, it seems that the government once again intervenes into industry by targeting specific sectors, which has previously proved to not be a successful strategy (Ozawa, 2001). Nevertheless, the reason for such targeting might be that the government strategy is to "turn challenges into new markets" (Prime Minister of Japan and His Cabinet, 2017:n.p.) because IoT is regarded as a vital source to solve socio-

economic issues in areas such as health, infrastructure or transportation. Also in this national strategy, the emphasis is put on the flexible and effective 'Public-Private Partnership', which corresponds with the establishment of public-private system mentioned already in the White Paper from METI. As described in the MIAC (2014) strategy, this public-private system will be based on: a) dispatching 'Public-Private Joint Missions' (top-level sales); b) constructing 'Public-Private Local Task Force'; and c) arranging mechanism for capital provision contributing to intensification of international competitiveness and global outreach in the field of ICT.

5.6 The Competitive Advantage of Japan

The analysis of the specific indicators of the competitive advantage has enabled to reveal the current state of the ICT/IoT sector in Japan in order to assess the strength of its competitive advantage. Figure 6 below summarizes the assessment of the main indicators that represented each of the four elements constituting Porter's Diamond Model. The competitive advantage of the ICT/IoT sector is considered to be rather weak and thus, it may be difficult for Japan to foster its socio-economic development in the future. Based on the respective indicators, the Factor Conditions and Clusters are evaluated as the weakest elements of the Diamond Model defining the competitive advantage of Japan in the ICT/IoT sector. According to the recent statistics, factors of production such as technology-oriented education, employment in ICT, R&D spending and patent applications that represent vital sources for the industry do not show positive improvements. On the contrary, Demand Conditions seem to be stronger based on the growing trend in most of the indicators. There are millions of IoT devices in use and the revenue in IoT sector is increasing. However, even in this area it can be argued whether Japan will be able to contribute to its competitiveness because other countries are ahead. This means that Japan is once again in the 'catch-up' phase as it was in the past.

In terms of the other two indicators that are concerned with the industry itself and its major players, the investigation revealed that Firms within the ICT and IoT sector are represented by major conglomerates that have a long history in Japan. The time of their establishment goes back to the 19th and 20th century. It is also shown that they are part of the long-term networks (JIC and INCJ) that ties down entities such as banks, government, shareholders and other business partners. These strong and long-lasting linkages could negatively influence the competitiveness of the industry and subsequently the nation because of the difficulty to adapt to the requirements of the digital era such as agility and fostering innovation. This is usually

the domain of the newly established firms without complex organizations (Weiblen & Chesbrough, 2015) that are limited in Japan in comparison to other countries and proportional to the population. Nevertheless, even if there were more startups, it is unlikely that they would be able to penetrate the established structures created by the corporations and government.

Although, it is clear that the analysed Japanese corporations set up their strategic directions around innovation within the ICT and IoT sector. They also realize that this business direction can contribute to socio-economic prosperity of the country. Additionally, it is important to note that the well-established relations within networks might facilitate the cooperation and partnership between industry players in order to share information in a fast and efficient manner. This leads to the assessment of the Cluster environment in the ICT and IoT sector, which is strengthened by the intensive R&D focus. Nevertheless, the Clusters are influenced by the government, which tries to coordinate various R&D projects as a source of innovation for the industries in targeted locations. However, there is a relatively low amount of R&D projects that involve the ICT and IoT sector in comparison to other industries.

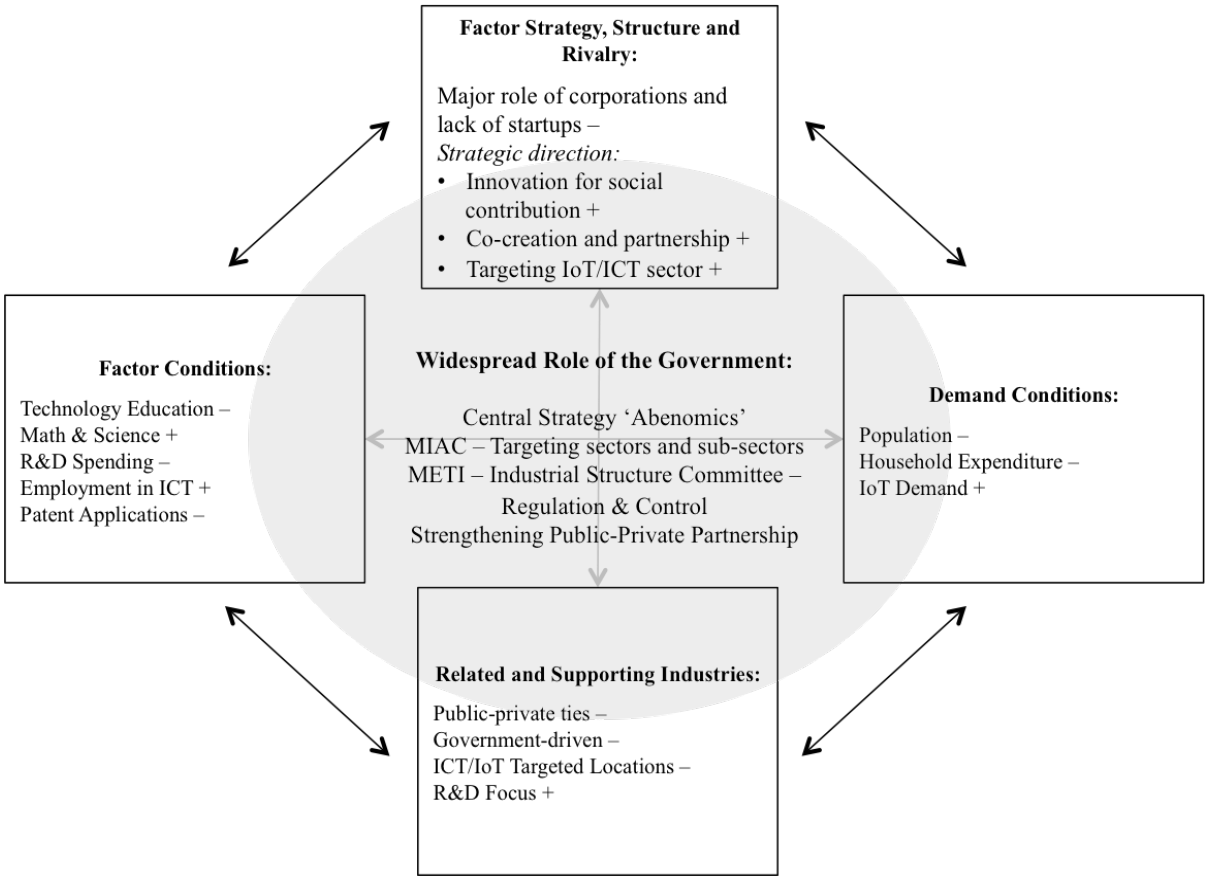
Lastly, the government defined the strategies in which the ICT/IoT sector is recognized as one of the most important sector, which needs to facilitate innovation in order to gain the competitiveness in the current digital era. The major role lies with MIAC and METI, which developed strategies that are aligned with the central strategy - Abenomics. The goal of the policies is to revive technological leadership of Japan by creating regulatory and institutional reforms. Thus, the role of the government has not really changed from the past. The similarity can also be recognized in targeting specific industries and emphasizing public-private partnership, which strengthens the ties between the government and corporations such as during the 1980s when this relationship was termed as Japan.Inc (Kingston, 2011).

It can be concluded that despite the fact that Japan recognizes the need to shift the focus to the ICT and IoT sector, it needs to catch-up to other countries because the indicators show that Japan's efforts to build a competitive advantage in this particular sector are so far insufficient. It is due to the linkages between the four elements of the Diamond Model. As Porter (1990a) suggests, a competitive advantage of the nation can be achieved when there is interplay between the four attributes. It was found that Japan has a low amount of startups, which relates to the fact that there is a shortage of technology-oriented labour (affected by

shrinking population), difficulty with assessing training and capital, lack of support of domestic startups, and chronic public-private partnership.

Despite negative projections of the national competitiveness in Japan, it is apparent that conglomerates have established a position in Japanese economy through which they can influence the competitiveness, and therefore play a major role in the creation of Japan's competitive advantage in the ICT/IoT sector. Yet, the role of the government in relation to the ICT and IoT sector is widespread across all four areas that create the diamond of national competitive advantage.

Figure 6. The Diamond Model capturing the competitive advantage of the ICT/IoT sector in Japan



Source: own

6 Conclusion

This thesis has investigated the specific industry of ICT and in particular the IoT sector, which are considered to be a vital sources of potential socio-economic development in Japan in the current digital era, also acknowledged as The Fourth Industrial Revolution. The main motives of this research are based on the fact that Japan once was an East Asian 'miracle' because it achieved significant economic success through technological leadership in various industries such as consumer electronics and automobiles. Nevertheless, the economic prosperity was interrupted by a series of crisis, which were partially caused by the misguided policies of the Japanese government. There have been many attempts to understand the key drivers behind the Japanese miracle as well as the debacle from the economic and development field. One of the explanations revolves around the development through innovation, which was based on the analysis of the competitive advantage by Porter (1990a). He argued that in the increasingly globalized world, companies are gaining a significant role because they drive innovation that reflects the competitive advantage, which might be a source of economic prosperity of the nation. In his findings, he revealed that Japan was not a radical innovator but the innovation sparked due to the strength in human resources, demand pressures and domestic conditions (Porter, 1990a).

However, the development is a never-ending process (Porter, 1990a; Ezeala-Harrison, 1996), and therefore it was important to examine the competitive advantage of Japan based on the industry that is relevant for the current digital era. The author chose to use the Diamond Model as a framework for the analysis because this allows for enlarged and 'refreshed' discourse of the competitiveness of Japanese industry that might support the socio-economic development of the country.

The mixed methods research revealed that the competitiveness of Japan is relatively weak due to the interplay between the key drivers of the competitive advantage within the ICT/IoT sector. The factor conditions, which are a vital source for the industry, are anaemic. This was assessed based on the recent statistics in different indicators such as technology-oriented education, employment in ICT, R&D spending and patent applications. Most of these areas recorded recently showed a negative trend. Although, the demand conditions are the only attribute that could somewhat increases the competitiveness of the IoT sector, in comparison with other countries it indicates that Japan is behind its rivals and needs to catch-up in the

respective sector. The firms that operate in the ICT/IoT sector are multinational conglomerates with anchored positions in the economy. It is apparent that there is a prevalent legacy of the keiretsu system because the firms are aiming at cooperation and partnerships within the industry, which could either enhance or undermine the competitive advantage. Furthermore, there are limited incentives for new companies to be founded, which could arguably ignite innovation. Currently, the competitiveness of Japan is driven by conglomerates investing in foreign startups in order to fulfil their goals in the IoT field. The clusters should facilitate the competitiveness by enabling better cooperation between the firms. Nevertheless, the focus of clusters is on R&D projects related to government strategies that on one hand focus on IoT but on the other hand, the R&D projects target other sectors. Moreover, there are two similar public-private networks that maintain the chronic structures between corporations and the Japanese government.

Altogether, it points to the fact that Japan, as a country, did not become a radical innovator with the advent of the digital era because all four attributes of the competitive advantage negatively influence each other in the diamond system. Therefore it can be concluded that there is a *déjà vu* phenomenon in the current Japanese development because the country recognizes the need to shift the focus towards the ICT and IoT sector, yet it needs to catch-up with other countries that are already ahead. This argument is based on the findings that the efforts of the country to enable the competitive advantage in the digital era are insufficient. The corporations play a major role as they are supported by government incentives. In this system, the resources that are needed to spur innovation, which in turn drives the competitive advantage are redistributed among these influential entities. This means that the government devotes to its political agenda rather than effectively contributing to an enhancement of the competitiveness of the nation, which could subsequently stimulate the socio-economic prosperity of Japan.

Lastly, future research could contribute to the research phenomenon through deeper investigation of two factors of the competitive advantage. The firms and demand conditions could be analysed with qualitative research methods in order to reveal managerial practices, organizational structures and market demand. Moreover, there could be an investigation that measures the impact of the IoT sector on the digital economy. Consequently, this would confirm or refute the idea that digital technologies positively influence the development in Japan.

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