Clusters in Japan:

A Tri-Level Analysis

Dan Haave Eikenes

JAP4691 Master's Thesis - Modern Japan (60 credits)

Department of Culture Studies and Oriental Languages (IKOS)

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Abstract

This thesis employs the theories of innovation and clusters to help describe cluster in Japan on three different levels. Namely national, regional and company level. Policy papers and secondary literature is used to describe clusters on national and regional level. Expected trends among cluster participating firms are made in form of hypotheses based on innovation and cluster theories. These expected trends are then used as a background for doing a delimited illustrative case study on a biomedical firm called AnGes. The case study is based on information gathered mainly through annual securities reports. This thesis argues that clusters enhance the innovative capabilities of participating firms by creating an environment where collaboration is a key ingredient for innovation. Being a member of a cluster has been found to result in a high level of collaboration, which in addition to resulting in increased innovation reduces the cost for R&D and risk for failed projects. It has also been found that having competitive salaries strengthens the innovative capabilities of a firm by attracting highly regarded specialised personnel. The extra expenses that come as a consequence of overall increased salaries are compensated for largely by the reduced cost of renting office spaces and laboratories associated with being a part of a cluster. In addition to the case study, this thesis offers important insight into how clusters in Japan are organized and how they might affect the development of firms participating in a cluster.

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Finally, I'd like to thank my furry little friend Durin for always hanging around the computer while I was writing, often on top of the papers or lying on the keyboard.

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1 Introduction

三人寄れば文殊の知恵

(*Sannin yoreba monju no chie*) – Japanese proverb

If three people gather, they will have the wisdom of Monju

For sustaining economic growth, it is widely accepted that the industry needs to maintain their productivity and competitiveness through constant innovation. It is therefore a bit paradoxical that in a time when the world sees more and more globalization, there are often localized clusters of firms, research institutions and training institutions (from here on simply referred to as clusters) that produce the environment for the most innovative and competitive firms. This interaction of different actors plays an important role in increasing innovation and growth for the local economies, as well as in national economies. The benefits of the environment created by such a cluster may increase the efficiency and quality of goods and services. Even though firms may be competing against each other, there will also be actors that collaborate with each other. In industries that are highly reliant on research, companies may find it beneficial to collaborate or even localise themselves close to a university. Many of the benefits generated by clusters occur naturally, and there may be public policies and initiatives that help support the growth of the cluster. Among the naturally occurred benefits we may find knowledge spillovers and specialised local labour pool.

For my Master's thesis, I have decided to write about clusters in Japan. This thesis will cover clusters at three different levels, namely national, regional and company level. Since I started studying Japanese, I have always found it interesting how Japan managed to catch up with the West and to modernize as fast as she did. One reason for choosing this topic for my thesis was to combine a finished degree in engineering with interests in politics and studies on Japan. A study of Japanese clusters is also interesting in view of economic and sociological Japanese studies in general. Looking at clusters at three different levels gives insight into the relationship between central authorities and local initiatives. It will also show how basic science strengths, such as chemistry and life science etc., benefit from the traditional Japanese commercial strengths in mechanical and electronics. And in the end, linking the recent cluster and company level initiatives and policies aiming at commercializing life science's radical innovations. In addition, I think it is important for Norway to look at what other countries are doing to make them more competitive by being innovative. The word 'innovation' has been a hot word among Norwegian politicians since the fall of the oil prices and fewer jobs in the petroleum sector.

That is why my research questions are as follows: "How are clusters organized in Japan?", and "how can clusters affect the development of a company?" This thesis will focus specifically on medical clusters where the goals will be to offer a description of such a cluster by 1) providing renderings from policy documents and secondary resources, 2) detailed analysis of a particular cluster, and 3) providing a delimited illustrative case study, on a company within the chosen cluster. This study will be utilising policy documents, secondary literature, annual securities reports; and news statements in order to answer the research question. A major part of this thesis will be to look at how the company has chosen to collaborate with other members of the cluster. This could give us an indication whether cluster policy is an effective way for governments, research institutes, universities and industries to cooperate. In the end, I hope students of Japanese studies and other interested parties may find this thesis informative and useful, and that it might make more people interested in this aspect of industrial Japan.

1.1 Introduction to topic

The word innovation comes originally from the Latin word '*innovare*', which can be translated to '*to renew*' or 'to develop something new'. Often considered as the father of innovation research, Joseph Schumpeter (1934) discusses the importance of innovation for economic growth in a capitalist society. However, there are many types of innovations, but this thesis will use the definitions made by the Oslo Manual (OECD, 2005). The Organisation for Economic Co-operation and Development (OECD) defines innovation as follows (OECD, 2005, p. 46):

> An **innovation** is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.

In other words, an innovation can be a new product or service that is new on the market or it could be a new practice implemented by an actor. Often is innovation only associated with coming up with new products. The Oslo Manual splits innovations into four different types, namely product innovation, process innovation, marketing innovation and organisational innovation. There are many ways for a company to be innovative; and these types of innovations will be described in chapter 2, on theories.

The importance of inter-organizational networks has become an increasingly important stimuli for innovation over the last decade. Networks contribute to the innovative capabilities of the companies through easy access to resources and knowledge-transfer (Powell and Grodal, p. 79). Collaboration among actors may give the actors stronger research and development capabilities and reducing the risks of failed products through shared financing. Networking in industries may happen through many ways interaction; one of which is through clusters. A cluster is defined by Porter (2008, p. 213) as:

> Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (for example, universities, standards agencies, and trade associations) in particular fields that compete but also cooperate.

Through this definition of clusters, we can see that there are several different actors who will be working together in a geographically confined area. However, these actors may also find collaboration with actors outside the clusters beneficial. There are different types of clusters, depending on the nature of the industry it represents. The formation of clusters may happen intentionally or unintentionally. States may pursue the formation of clusters through policies, as seen in Japan. The Japanese Ministry of Economics, Trade and Industry (METI) launched the 'Industrial Cluster Project' in 2001 as an initiative to encourage university spinoffs and collaboration between industry and academia. This thesis will describe the initiative and other polices formed by the Japanese government, and in particular take a look at a biomedical cluster that was intentionally formed in Kobe after the great Hanshin earthquake in 1995. In order to understand how clusters may affect companies, I have chosen to do a case study of a company, Named AnGes MG, participating in the biotechnological cluster in Osaka. AnGes MG is a small firm that is engaged in developing medicine for gene therapy and therapeutic vaccines.

1.2 Structure of Study

Chapter 2 forms the theoretical basis for the thesis. These theories are the ones that this study is based on. This chapter defines relevant terms and details used in the thesis concerning innovation and clusters. The theory chapter will describe the different types of innovations based on the definitions made up by OECD's Oslo Manual (2005), namely product innovation, process innovation, marketing innovation and organizational innovation. The definition of an innovation is rather wide, therefore it is important to know of the different types of innovation. The cluster theories will be mostly based on Porter (1998). This will help us define what a cluster is; and how the economy may benefit from cluster formation. This chapter will also address the benefits of clusters; and threats to cluster development. In addition, chapter 2 will explain the connection between clusters and innovation; and the role of the government when concerning clusters. Chapter 2 will also explain formation of organizations and institutions in cluster through research done by Powell et al. (2012).

Chapter 3 will explain the methodology used in the thesis, and propose a hypothesis for expected trends among companies that participate in clusters. The methodology will be based on annual securities reports, policy documents, secondary literature and websites. The thesis will split the findings into three parts, namely cluster policy in Japan, information on chosen cluster and a case study of a company participating in the chosen cluster. Policy documents and secondary literature will be used to describe cluster policy in Japan. Information on chosen cluster will be based on information published by the cluster itself through their website. Lastly, the case study will utilise annual securities reports and new releases published by the chosen company. The hypothesis will be mainly based on the cluster theory from chapter 2 and some from the information gathered by secondary literature in chapter 4.

Chapter 4 presents the findings on cluster policy in Japan. The chapter starts out by explaining the cluster initiative (Industrial Cluster project) started in 2001 by the Japanese Ministry of Economy, Trade and Industry. This initiative will last until 2020, and takes shape in different stages along the way. One of the purposes of the initiative is to enhance the collaboration between industry and academia. The chapter will also give a brief introduction the 'Basic plan', which is a policy plan made up by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). These plans have many of the same focuses and goals as the initiative started by METI. To give us a picture on how these initiatives influence clusters in Japan, I have chosen to include secondary literature done by Arita et al. (2006) and Collins (2008). Arita et al (2006) covers several different clusters, in different types of industries. Collins's (2008) article describes the formation of the biomedical cluster in Kobe.

Chapter 5 will present a short introduction the chosen cluster for this thesis, namely the Osaka Bio Headquarters (OBH). This chapter will describe some of the attributes of the cluster and its goals. This chapter will be based on information published by the cluster organization.

Chapter 6 is my chapter about the case study done on one of the companies that participates in the chosen cluster talked about in the previous cluster. The company chosen for this study will be AnGes MG, hereafter AnGes. This is a small university spinoff engaged in developing medicine for gene therapy and therapeutic vaccines. I will utilise the hypothesis from chapter 3 as a basis for gathering information in the annual securities reports and news releases published by AnGes. This study will be looking at the performance of the company and how they choose to collaborate with other actors.

Chapter 7 will include the concluding remarks for this thesis.

2 Innovation and Cluster Theories

This chapter will introduce the theories that are relevant to my Master's Thesis. These theories will first and foremost cover the topics of innovation and cluster theory. There are several theories about innovation, and the theories in this thesis will be mostly based on the definition that is covered in The Organisation for Economic Co-operation and Development's (OECD) The Oslo Manual. This is to help us understand the term of innovation, and to narrow down what is presumed to be an innovation. As we will see that there are different types of innovation.

Then I will be looking at theories about 'clusters'. This will give us insight to why one should be looking at clusters, what kind of benefits they provide, and how they come to exist. These theories will be mainly based on the works of Michael Porter (1998). In addition, this chapter will also introduce research done by Powell et al. (2012) on how institutions and organizations have formed within a cluster.

2.1 Innovation

2.1.1 What is innovation?

One could argue that innovation is one of the most important elements for a firm for it to survive. Joseph Schumpeter (1934) is often referred to as the first scholar to give the idea that innovation is so important or vital to a capitalist development of the economy, innovation being the main engine to this development (Hauknes 2003, Shrolec 2005). However, not going further with theories by Schumpeter, this Master's thesis will be using the definition of innovation as it is stated in OECD's Oslo Manual (2005). Innovation is defined in The Oslo Manual (OECD, 2005, p. 46) as the following:

> An **innovation** is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations.

As we can see from this rather broad definition is that an innovation can include more than one type of innovation. For example, in order to implement a new product to the market, the firm that is producing it might have to change the way they are producing products. This means that a firm will be involved in both product and process innovation. In addition, OECD's (2005, p. 46) minimum requirement for an innovation is that the product, process, marketing method or organisation method must be new or significantly improved to the firm that implemented the innovation into their practice. Further we need to know what kind of activities that are considered as an 'innovation activity':

> Innovation activities are all scientific, technological, organisational, financial and commercial steps which actually, or are intended to, lead to the implementation of innovations. Some innovation activities are themselves innovative, others are not novel activities but are necessary for the implementation of innovations. Innovation activities also include R&D that is not directly related to the development of a specific innovation (OECD, 2005, p. 47).

In this definition of innovation activities there is a common feature that every innovation has to be implemented, whether it is a new product that hits the market or if the innovating firm is implementing new practices in process, marketing methods or organisational methods. These activities are considered as innovations "when they are brought into actual use in the firm's operations" (OECD, 2005, p. 47). As we can see from these definitions, it is that a firm can be innovative even if the firm is not engaged in well-defined innovation projects, such as developing products the world has never seen before.

2.2 Types of Innovation

Innovation can in general be subdivided into four groups. These are product innovations, process innovations, marketing innovations and organisational innovations.

2.2.1 Product innovation

A *product innovation* is when you introduce a totally new product or significantly improved product when looking at the characteristics of the product and its intended uses. These improvements might include change to the technical specifications and which components that are used to produce this product (OECD, 2005, p. 48). This means that new products need to significantly differ from the former products that are delivered from the firm. An innovation can also be a product that includes a combination of several existing technologies; for example, installing telephone capabilities, heartrate monitoring or a GPS to a watch. A change in technical specifications can be looked upon as a minor change to the product innovation. As an example, a product can change its chemical composition to something that was intermediary used in another product to improve its performance. Significant improvements can happen when you change the materials, components and other characteristics to a product. For example, changing the materials in bicycles to carbon fibre will enhance its weight making it lighter. Another example is adding more components to a car, such as integrating GPS and adding carbon fibre brakes. This will be considered by OECD (2005, p. 48) as one or more improvements to the integrated technical subsystems. There can also be product innovations in services. These innovations will improve the service significantly, for example when it comes to efficiency and speed, but also addition to new functions to existing service (OECD 2005, p. 48-49).

2.2.2 Process innovation

The second type of innovation is *process innovation*. A process innovation is the significant improvement in the production or delivery method. This could include changes in techniques, equipment and/or changes to the software that is used (OECD, 2005, p. 49). The reason for improving production or delivery is to decrease the production costs or delivery costs. In addition, it might also increase the quality of the product, or being able to produce new or significantly improved products. These production methods involve new techniques, equipment and software that is used to produced goods or services. For example, the introduction of production lines in factories or implementing software to production, such as CNC (computer numerical control) technology applied to plasma cutting. Delivery methods have to do with the logistics of the firm. Here an innovation can be equipment, software and techniques to source inputs, allocate goods or deliver final products (OECD, 2005, p. 49). This could be a new and improved way of delivering goods or the introduction of GPS (Global Positioning System) in tracking devices in transport services.

2.2.3 Marketing innovation

The third type of innovation is *marketing innovation*. This type of innovation includes the implementation of a new marketing method, which involves significant changes in product design or packing, product placement, product promotion or pricing (OECD, 2005, p. 49). These changes are made to better addressing customer needs, as well as to open up to new markets or to improve the firm's sales. The implementation of a new marketing method must be totally new to the firm, as they cannot have used the new marketing method on a previous occasion. The new marketing method must come from a new marketing concept or strategy. However, the new marketing method does not have to come from the innovating firm itself. A firm can adopt a marketing method from another firm or organisation (OECD, 2005, p. 50). Market innovation can be significant changes to the packing of a product to go with the new marketing strategy. However, seasonal changes to design are not innovation if they have been used in previous marketing campaigns. The innovating firm can also seek new sales channels, meaning that the firm seeks a new way to sell their goods. A good example could be a local retail store that opens up an internet store. By opening up an internet store, the firm can then sell goods or services to a broader customer group, as they do not have to solely rely on local sales anymore. Other, new marketing methods in production promotion is when the firm use new concepts of promoting their product or service. This can include promoting the firm's product in new media channels, such as TV commercials or the firm can use celebrity to promote their product. Renewing the brand's logo to get a new image of the product is also considered as a marketing innovation (OECD, 2005, p. 50). However, the use of existing marketing methods on new or other geographical market or market segments, are not considered as marketing innovation.

2.2.4 Organizational innovation

The last and the fourth innovation type is '*organisational innovation*'. The Oslo manual (2005, p. 51) says that this is the implementation of a new organisational method in the firm's business practices, workplace organisation or external relations. These organisational innovations are aimed to enhance the performance of the firm. This may occur by reducing the cost of administration or transactions. As well as improving the satisfaction on the workplace. Increasing the satisfaction on the workplace might increase the labour productivity. The innovating firm can also gain access to non-tradeable assets such as personal, experience-based knowledge or reduce the cost of supplies (OECD, 2005, p. 51). When talking about organisational innovations in business practices, this concerns new methods of organising routines and procedures for the conduct of work. The Oslo Manual (2005, p. 51) says that this is the implementation of practices to aimed to improve learning and knowledge sharing within the firm. This could be databases for lessons and best practices, which are accessible to all employees. Innovation in business practices could also be an improvement to the development and education and training system of employees. Innovation in workplace organisation includes new methods for distributing responsibilities and decision making, in addition to new concepts for structuring of activities (OECD, 2005, p. 52). The Oslo Manual (2005, p. 52) mentions that this could be the integration of engineering and development with production. When it comes to innovation in external relations, innovation can involve new practices to organising relations to other firms. This could be new connections established with other firms or public research institutions. As well as establishing connections with customers and suppliers. If these changes to organisation all already in use, just that they are for example used in connection or collaborations with another institution, they are not considered as an innovation. Mergers with or acquisition of other firms are neither considered as an innovation.

2.2.5. Innovation summary

As we can see from the descriptions of these types of innovations, there are many ways for a firm to be innovative. The firm can be innovative in all these ways. When a firm has made a new product, it might have to change its way in which it produces this new product. The innovative firm might also have to come up with a new way of marketing this new product, either to reach new markets or to give it an appeal so that it might reach the consumers and enhance the sales of the new product. All of this comes within the desire of being more competitive compared to other rivalling firms, as a way of surviving in the market. This brings us to the new topic in this chapter that concerns clusters.

2.3 Cluster Theory

Clusters have become an object of interest for academics and policy makers in recent years. This is especially the case for when policy makers want to enhance a region's economics and competitiveness. Attention to successful clusters such as Silicon Valley in San Francisco, gives the idea of attempting similar projects in their own regions, whether it be a developing or developed economy. This subsection of the chapter will be focusing on theories concerning clusters, and mainly the theory presented by Porter (1998).

2.3.1 What is a cluster?

There are various related concepts surrounding cluster, which can be related to developments of locally groups of firms and other organisations. This could be 'industrial districts' as Brusco (1982) is writing about in his article 'The Emilian Model' or it could be 'regional innovation systems' (Carlsson et. al 2002, Cooke et. al 1997, Hekkert et. al 2007, Nelson 1993). Most of the theories concerning clusters are based on the idea that clustering enhances the innovation ability of the firms that are embedded in a cluster. One of the effects of a cluster is known as 'knowledge spillover' (Audretsch and Feldman, 1996). This effect can come from the flow of labour exchange that happens between the firms within a cluster, as well as the face-to-face interaction between various agents in the cluster. Most of the increasing interest in clusters in recent years is credited to the interest of Porter's (1998) work on competitive advantages of nations. In Porter's (2008, p. 213) research, clusters are defined in the following way:

> Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in

> related industries, and associated institutions (for example, universities, standards agencies, and trade associations) in particular fields that compete but also cooperate.

However, this definition does not say anything about whether the cluster has emerged by itself or if it is constructed through policy. The boundaries of these clusters are often linked to a single administrative area, but they can also span over different provinces and even states. One such cluster can, according to Spencer et al. (2010, 700-701), often constitute a specialisation within a particular industry.

2.3.2 Types of clusters

There are controversies within the literature regarding how to identify cluster, how they came to be and evolved, why one should encourage clusters and what kind of policy to adapt in order to make clusters emerge or to assist them in evolving. As Porter (2008, 220) says, "Clusters do vary in size, breadth and state of development". As we can see from this statement, the characteristics of a cluster vary, and there have been authors who proposed different types of clusters. Such as Enright's (2003, p. 103-104) proposal to differentiate clusters as 'working clusters', 'latent clusters', 'potential clusters', 'policy driven clusters' and 'wishful thinking' clusters'. There are on the other hand those who are critical to this way of classifying clusters. As Martin and Sunley (2003, p. 13) state: "almost any company or firm can be a part of a potential cluster". In the quest to differentiate the types of clusters formation, Markusen (1996, p. 296) has proposed four characterisations of industrial clusters, which are defined as 'hub-and-spoke', satellite platform', 'Marshallian industrial district' and 'state-anchored districts'. The Marshallian industrial district originates from the formulation by Alfred Marshall. This type of district consists of many small firms that are locally owned and driven. The linkage between firms and competition would also mainly be local. The flow of labour would also be local, as workers would be going between the local firms. In addition, key investments would also be made locally (Markusen, 1996, p. 297-298). There have also been proposed ways to identify in which state of development a cluster is currently in and how they emerge. For example, Kuchiki and Tsuji (2011) have come up with something they call a 'flowchart approach'. This framework is established to help identify and explain the formation and growth of economic agglomerations and industrial clusters in East Asia. They say that clusters go through different stages, such as having industrial agglomerations as a first stage, followed by a stage consisting of an innovation processes. Potter (2009, p. 24) notes that in order for a cluster to survive it needs to evolve over time, through adaptions to changes in technologies and markets. Porter (2008, p. 223) says that "cluster theory…advocates building on emerging concentrations of companies and encouraging the development of those fields with the strongest linkage to or spillovers within each cluster". Hospers et al. (2008) also note that the origins of clusters lie in older economic activities and structures. There are several cluster programmes and initiatives that are initiated by policy makers. However, Potter (2009, p. 26) mentions that the role of policy should be carefully assessed. According to Porter (2008, p. 263), governments should support clusters that are already functioning and emerging clusters, rather than attempt creating entirely new ones. Yusuf (2008, p. 3) points out, it is a lot easier to form policies for a cluster that is already functioning and it is incredibly hard to establish a new cluster. Even well-developed clusters can suffer from lock-in, which is when clusters will lose their competitive edge, innovativeness and flexibility if it does not manage to identify when its products are past their primes and there is a need of change in what they produce.

2.3.3 Benefits of clusters

Why, then, should states and regions pursue cluster formation? There has been extensive research on the advantages coming from geographical proximity. Marshall (1920) has identified the three distinct drivers of agglomeration: knowledge spillover, input-output linkages and labour market pooling (Delgado et. al, 2010, p. 497). All of which contribute to generate innovation and productivity benefits. This proximity also makes it easier for companies to search for specialised employees, and this for a lower search and training cost. One of the other benefits of being in a cluster is the reduced cost of transportation. This also gives easier access to specialised materials and components, as well as clusters focuses to build up public goods that may impact linked business (Porter, 2008, p. 266). Participants in a cluster may have access to better finance, marketing and business services. Within these markets, demanding customers and rivalry makes companies more productive and innovative because of the competition they present. As Porter (2008, p. 238) puts it: "…advantages for innovation are the sheer pressure—competitive pressure, peer pressure, and constant comparison-- Occurring in geographically concentrated clusters". This means that companies in these clusters are forced to make themselves stick out; there is a need for these companies to distinguish themselves creatively. As mentioned above, the transaction costs may be reduced and the flow of information might improve. There have been many dedicated studies to describe the benefits of clustering. These studies are often based on empirical studies on clusters that are successful, as it might be easier to find trends and tendencies to positive cluster growth when the cluster is thriving, rather than declining. The study by Spencer *et. al* (2010) is one of these studies that has looked at clusters in Canada. They found that: "…evidence shows that when industries are located in an urban region with a critical mass of related industries, they tend to have both higher incomes and rates of growth compared with when they are situated in a non-cluster setting" (2010, p. 712). These economic benefits allow the increases in wages, profits or price competitiveness of local enterprises (Potter, 2009, p. 27). Potter (2009, p. 27) further notes that this can create a circle of growth as the environment of higher productivity will generate new firms and firm expansions. This circle will in turn also increase the size of the cluster, thus strengthening its productivity benefits. Being able to pay higher wages will also attract highly productive employees, making it desirable to work in such an environment.

2.3.4 Clusters and innovation

As mentioned earlier, one the benefits of a cluster, is the increased ability to innovate. Being able to innovate is also at the heart of economic growth. Being in proximity of to buyers and suppliers gives the firms in a cluster an advantage to see where market trends are pointing. In addition, being in constant contact with such actors will often help firms within a cluster perceive more clearly and rapidly new buyer needs (Porter, 2008, p. 237). Firms within a cluster may establish tighter relationships with buyers, thus enhancing customer knowledge. It will be easier for the innovative cluster to diversify and make the transaction to a new product line (Yusuf, 2008, p. 2). Yusuf (2008, 18) also notes that successful clusters have diversified by changing their product lines. As an example, he mentions Silicon Valley, which started out as producers of semiconductors, but is now also heavily involved in electronics, biotechnology, nanotechnology and ICT (information and communication technology). Yusuf further notes (2008, p. 19) that it is difficult to "bring a cluster into existence by dint policy", but it is also difficult to make a cluster innovative. It is important for firms to be able to rapidly implement innovations. This aspect is also mentioned by Porter (2008, p. 237), and concerns all types of innovations, be it a new product line, new process or new logistics model. It is easier for firms in a cluster to innovate, Porter says (2008, p. 237), because it is easier to tap the local labour pool for new, specialized personnel that is needed to fill the vacant spot needed to innovate. This will be more difficult for firms relying on distant sources of information and labour pool. Being further away from such sources might be costly. New businesses are more likely to form in an existing cluster, rather than forming at an isolated location, according to Porter (2008, p. 240). This happens because of the information about opportunities is clearer within a cluster, as cluster is the signal of an opportunity (Porter, 2008, p. 240). As for forming new businesses, within a cluster there will be easier to find needed assets, skills, inputs and staff. Even the investors and financial institutions have more knowledge and information about the cluster, so it might be easier to get financial support for new enterprises. Entrepreneurs can utilise their established relationships and networks (Porter, 2008, p. 240).

One of the main factors that contribute to innovation in a cluster is the firm's affiliation to research institutes and universities. However, not every type of industry might gain the benefits of being in a cluster. Potter (2009, p. 32) mentions that industries that rely heavily on the transfer of tacit knowledge are the ones that have the most benefits, such as biotechnology and nanotechnology. These types of technology are often heavily linked to research done at universities. If these universities (with emphasis on engineering and science) and research institutes are world-class, they will most likely attract the most talented students and faculty members. This will give the cluster an extra edge when it comes to innovation. This edge will be even sharper if there is a culture for support for entrepreneurship, with many role models and has a system that rewards success and is tolerant of failure (Yusuf, 2008, p. 19). Key elements to innovation are the informal and oral information about market needs and technological possibilities, where unanticipated and/or unplanned encounters might be the most valuable (Enright, 2003, p.107). Homogeneity is not always the way to go, according to Yusuf (2008, p. 19), a diversity of several interlinked industrial subsectors (such as electronics, engineering and automotive parts) will supplement each other and then multiply the possibility for innovation. As Porter (2008, p. 261) puts it: “The ultimate test of the health or decline of a cluster is its rate of innovation. A cluster that is investing and innovating at home is of far less concern than one that improves productivity only through shrinking and outsourcing”.

2.3.5 Threats to cluster performance

There are however potential threats to cluster performance. One of these threats can be the effects of overspecialisation, which is associated with long term lock in. This is when a cluster is unable to adapt to new market trends. This can happen because of a particular dominant technology or product (Grabher, 1993). Other things like research and training activities only fit these dominant technologies and products will lead to a decline when technologies and markets change (Potter, 2009, p. 28). When there is a growth in production, there will also be a growth in profit and wages or there can be price reductions and output and employment growth. If this positive cycle continues, then a cluster may attract new firms, either existing ones or new start-ups and increase in internal investments. This may end when costs of wages, land prices and other costs rise and matches the productivity advantages (Potter, 2009, p. 31). When everything is next to each other, there is a thought that intellectual breakthrough spillover will more likely happen in this proximity, instead of somewhere else.

As mentioned earlier, the concept of cluster formation and development has been well received by policymakers, but there are economists and geographers that are more sceptical. They say that the cluster concept is just too wide, and it is hard to identify which policies that work. In addition, there is no guarantee of positive results, just because they are implementing cluster policies. However, there are several studies done that say the likelihood of increase in innovation is to happen if the cluster policies succeed (Falck et. al, 2010, p. 1-2). Most research on clusters has mentioned that clusters have a positive effect on innovation. However, Martin and Sunley (2003, p. 22) suggest that this positive effect only occur in specific industries, at certain stages of development, in certain places and under particular conditions. Audretsch and Feldman (1996, p. 639) concludes that there is a link between industries and innovative activity when new economic knowledge plays a greater role. New economic knowledge is found in research and development (R&D), university R&D and in a skilled labour pool. In essence, the knowledge spillover is one of main factors for generating innovation.

2.3.6 Role of the Government

In each cluster program, there is a different degree on how much the government is involved, what kind of original industry the cluster evolved from and the nature of government intervention. Enright (2003, p. 119) notes that governments with different ideologies and philosophies have promoted policies for clusters. For example, both liberal and conservative states in the U.S have adopted cluster policies. In Canada, the most interventionist and the most non-interventionist provinces have also adopted policies for clusters. In addition, European governments, regardless of left or right side of the political spectrum, have also initiated cluster based strategies. This is a trend that is seen all over the world[1]. This means that there are many ways to interpret how clusters should develop when there are so many different types of governments that are adopting cluster based strategies and policies. Depending on the size of the cluster, the appropriate level of government involvement in cluster development should correspond to the geographic scope of the relevant cluster It is more difficult for a government with a large area to be able to focus sufficiently on the needs of a local cluster. As for governments with smaller jurisdiction over an area that is smaller than the cluster's scope may have a hard time getting a full view over the whole system of need for a cluster to able to develop. Enright (2003, p. 119) points out that nations with weak or non-existent local or regional government will not able to or have a difficult time to create entities that will enhance the development of clusters. According to Porter (2008, p. 261), the government has three different roles. The first is to achieve macroeconomic and political stability. In order to achieve this goal, there is a need for stable government institutions, consistent basic economic framework, and sound macroeconomic policies, including prudent government finances and low inflation. The second role of the government is to improve the efficiency and quality of the educated workforce, having good physical infrastructure and having accurate economic information. The last role of the government should be to establish

[1] For a list over different cluster initiatives, see http://www.cluster-analysis.org

rules and incentives for competition, which will generate productivity growth. These rules and incentives could include competition policy that enhance rivalry, a tax system and intellectual property laws that encourage investments, fair legal system, corporate governance rules holding managers accountable for performance, and an efficient regulatory process promoting innovation rather than freezing the status quo.

Enright (2003, p. 119) lists five different types of government intervention. The First one is the ‘non-existent’. These types of governments do not have any cluster-based policies. The next one he calls ‘catalytic’. When the government takes upon the role of the catalytic, they want to bring interested parties together. The government takes an indirect role to encourage the private sector to take efforts for developing the cluster. They do not provide much support and little direction. The third one is called *supportive*. The government supports clusters by having policies towards investing in infrastructure, education, training or passive promotional support. This brings us to the next type of intervention where the government takes a direct (directive*)* role in the development. The government will either have directive targeting programs towards the cluster program, or the government will use the cluster program to reshape the local economy. The last one is called ‘interventionist’. The government makes all the major decisions concerning the development of the cluster, rather than having the private sector making them. The government can also do this actively by granting subsidies, targeted attraction incentives, protection or regulation to develop the cluster. The government could also have the control and ownership in the cluster (Enright, 2003, p. 119-120).

There are many ways for a government to support or direct the cluster development. However, as mentioned earlier in this chapter, many benefits of a cluster happen naturally, means without any policy intervention. One cluster development approach can be more beneficial for one government, than it would be for another. This is because there is more than one factor that determines the actual growth of a cluster. Such factors can be the geographical scope, type of industry, natural or produced cluster, cultural differences (business model, labour flow etc.) and/or governmental ideologies.

2.4 Biotech clusters – The formations of internal participants

I will now focus on how institutions and organizations are formed in life science and biotechnology clusters. This section is based on an article by Powell, Packalen and Whittington (2012), consisting of a chapter from a book entitled *The Emergence of Organization and Markets* (Padgett and Powell, 2012). In order to shed light on why biotechnology clusters have formed and evolved as they have, they explore the start-up of the biotechnology industry and the areas where they appeared. In essence, their article provides insight into the bottom-up formation of organizations and institutions that usually serve as the backbone for generating clusters. They also explore the development of these clusters, both successful and failed ones, and transformed biotechnology clusters that do not look the same at the beginning of their formation as when they are developed. Often, the clusters able to adapt will be those able to survive (Powell et al., 2012, p. 434-435). Although this article is not about a cluster in Japan, it makes some interesting points about the formation of clusters and biotechnology clusters in particular. This will be relevant to see how a cluster and companies in Japan are organized.

First, their article recounts the narrative of the way in which the biotechnology industry in the US came into being. At the time of writing, approximately 50 percent of the life-science industry is located in three different areas: the San Francisco Bay area, Cambridge and Boston in Massachusetts, and north San Diego County. It could not be assumed that these three areas would succeed in becoming sustainable areas for the biotechnology industry on their inception. They also state that it cannot be assumed that a company located in a cluster is bound to thrive, since competition is harder in such environments, implying that in order to survive, companies will have to 'run faster'. Moreover, the technological breakthroughs and the capital that led to the formation of the industry occurred in other places in the US as well, as well as at institutes worldwide. One of the reasons for what has been dubbed 'geographical propinquity' is that knowledge spillover takes place in clustered areas. Furthermore, spillover cannot explain why one area thrives while another does not, even though both areas shared the same circumstances. The successful cases are reportedly more flexible, whereas unsuccessful cases suffer from lock-in. There were many possible areas that could have developed into robust clusters, but have not yet catalysed as such.

The article continues by introducing theories about networks and transposition." Transportation" is defined as 'the initial participants brought the status and experience they garnered in one realm and converted these assets into energy in another domain'. There are two features and one mechanism central to this argument. The core factors are mentioned as a diversity of organizational forms and the presence of an anchor tenant. The mechanism is cross-realm transposition. By having a diverse organizational picture, the cluster or community will have more 'feet' to stand on in 'bad times'. However, and more importantly, having a heterogenic community will generate more diverse sets of rules and standards. The interaction between participants refines these practices and facilitates their internalization. As far as anchor tenants are concerned, they are actors that facilitate subsequent connections and field formation. Such anchor tenants could be well connected to universities, non-profit institutes, venture capitalists or a company, all of which work for the common good of the community. They may mobilize others and foster collective growth. On the opposite side of the spectrum, there are the dominating actors that dictate the pace, making others play by their rules and not engaging in collective problem-solving. Moreover, anchor tenants continually recombine and repurpose diverse activities. This means that anchor tenants can build an open platform where others can build on for community-wide benefits. Lastly, it is mentioned that there is a need for a cross-network to transfer ideas and information over to other domains.

The authors continue by discussing their methods and data and data used. In short, they have studied several different areas and have looked at the connections and forms of collaboration between biotechnology companies, universities and other links within these areas. In addition to a quantitative database, they include interviews and their own observations. The article then discusses the origins of the earliest biotechnology companies and communities. They compare four different points: '(1) the organizational diversity in the regions; (2) the effects of anchor tenants; (3) the role of cross-domain networks; and (4) the sequence of network formation'. The character of the region is marked by the diversity of its organizations, the kinds of ties they have and the characteristics of the central nodes, all of which determine the information flow in the community. This indicates that there are multiple factors that need to be fulfilled in order for a cluster to develop and survive. Different factors may be more important in some clusters compared to others, as seen in the articles mentioned above in this chapter.

Powell et al. (2012, p. 444) then look at the Boston cluster. They examine the institutional form of the most central organizations and how they have shaped the practice within the cluster to pinpoint whether they have influenced spillover and innovation. To discern the development of the cluster and the connections within it, they look at different points in time and then compare them. At first - in the beginning of the 1990s - the most notable connections were between research institutes and universities. A decade later, the companies were notably more connected, but the picture remained dominated to a greater extent by research organizations. In addition, the cluster was successful in commercializing newly found knowledge. The Boston cluster is then compared to the San Francisco Bay area cluster and San Diego county cluster. Compared to the Boston area, the San Francisco Bay area cluster started out with collaboration between scientists and venture capitalists. At a later point in time, there was considerably more collaboration between competing companies. The San Francisco Bay area was good at adopting commercialization and getting universities to support entrepreneurship. Furthermore, different domains adopted norms from cross-realm interaction, such as adopting university lab culture into commercial companies). In comparison to the other clusters, the San Diego cluster spent a long time developing, and the trigger was in fact the failed acquisition of a company by another, larger company. Former employees did not want to leave the San Diego area, so many started their own firms. This led to the formation of many small companies with their origin in a single company. In addition, there was a strong, local research community that could 'lure' venture capitalists from the San Francisco Bay area. All these narratives seem to indicate that there is no recipe for the successful formation of a cluster. Lastly, the article compare the three successful clusters to the eight areas which had the potential to be robust clusters, but which never emerged as such. In short, there was little change in the organizational picture. Some had the same dominant actors throughout the decade, 1990s and onwards. These heavyweights could 'call the shots' and dominate the culture within their respective area. Other areas did not spawn new start-ups, and there was little to no collaboration between companies. It is mentioned that it is the predominance of a single type of organization that may essentially hinder the emergence of a cluster.

Powell et al. (2012, p. 459) provide the following conclusions. Biotechnology has its roots in the laboratory, implying that the industry in highly dependent on having links with scientists, whether such links are based on the company's own researchers, or its connections with universities or research institutes. Being dependent on such knowledge also implies that there is a need for laws that help foster innovation and new research through intellectual property and patenting laws. They also mention the need for public support through the financing of R&D, although there is little mention of this factor earlier in their chapter. Their main argument is that there is a need for diversity in organizations and anchor tenants, who are the ones that link all the actors together in the cluster and help build bridges across different industries and spheres, i.e. 'transposition'. This produces shared expectations, helping to generate local norms for collaboration and knowledge exchange. Public research organizations were most influential among Boston actors, but they were also of importance in the two other successful clusters. Public research organizations, such as universities, non-profit research centres and hospitals are considered to be 'leaky', because information easily enters and exits such organizations, which may seem to function as 'high-speed gossip networks to carry stories of malfeasance'. In the San Francisco bay cluster, venture capital was one of the main reasons for the emergence of a biotechnology cluster, as it provided a bridge to transfer science to the market. It also transformed university labs into a form of business management, though faculty members were not prepared for such a role. Venture capitalists helped transfer business practices from the other successful industries in the area, such as semi-conductors and IT, to the newly founded biotechnology industry. In San Diego, we have seen that something as 'unusual' as a failed merger produced many spin-off companies. These actors became partners instead of competitors, becoming 'serial entrepreneurs'. The flow of information through job mobility was crucial for the cross-network transfer of knowledge in all of the successful clusters. One last point they mention is that all the past experiences the actors had gained from universities, venture capitalists or from former employees from established companies, shaped the way the organizations thought about how science-based companies and institutions could be organized and how all the actors in the area should collaborate.

2.5 Summary

In this chapter, we have looked at the definition and different types of innovations given to us by OECD's The Oslo Manual. It is important to distinguish the different types of innovations from each other in order to see how a firm can be innovative. This chapter has also introduced us to theories about clusters and what kind of benefits such agglomeration of different actors can contribute to the environment of an industry. Lastly, I have included an article by Powell et al. (2012) to give us more insight to how organizations and institutions within a cluster may form; and to stress the importance of human relations within these organizations.

3 Methodology and Hypothesis

3.1 Methodology

This chapter will take a look at the method I have chosen to use in this Master's thesis, and to make a hypothesis for expected trends concerning companies in a cluster. In order to look at a cluster in Japan at three different levels, I will make use of secondary literature and policy documents to help describe national and regional initiatives for forming clusters in Japan. The first chapter on my findings is about the cluster policy in Japan. This chapter is based on policy documents and secondary literature. The policy documents are mainly published by the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) and Japanese Ministry of Economy, Trade and Industry (METI). METI launched a cluster initiative called 'Industrial Cluster Project', with the aim to increase the collaboration between industry and academia in Japan, over the course of approximately 20 years. There will also be a brief description of the promotion of science and technology through 'Basic plans' are covered in the policy documents published by MEXT. The secondary literature is included to give us an insight to clusters on a regional basis. These secondary literatures consist of articles by Arita et al. (2006) and Collins (2008). Arita et al. covers several clusters on a regional level; and Collins covers a study done on the biomedical cluster located in Kobe.

The last part of my thesis is a case study on a company in the chosen cluster, this case study will be based on information gathered in annual securities reports. I will give an explanation to how and why I have chosen to use the annual securities reports as my main source for information for research on company level. Grønning (2016) has written an article about the usage of securities reports as a source for entrepreneurship, innovation and technology research. This article takes a look at how firms perceive risks in the annual securities reports. In the article, Grønning uses four different firms, three from Japan and one from the US. The goal of my analysis on the company level was to use the annual securities reports as a source to look at how a company that participates in a cluster has developed over the course of five years. There are two types of annual securities reports, one is submitted to the authorities and the other is aimed for shareholders. I have used the reports submitted to the authorities. I have chosen to only look at data published on the company website and the annual securities reports because of the limited scope of the thesis. Because of these this limited scope, there are several things I had to keep in mind when doing the research. Using the annual securities reports as the main source of data has limitations in itself. It is only companies that are registered on the stock market that must submit annual security reports. This means that it is limited how many possible candidates it is possible to find among the small and medium-sized companies to do research on (Grønning, 2016, p. 18). I have chosen to look at the firm called AnGes MG, hereafter called AnGes. The reason for choosing AnGes is because it is considered a small company, with fewer than 70 employees. I think it will be more fruitful to look at a smaller company when doing research on cluster participating companies. The initiatives of a cluster are most beneficial for small and medium-sized companies, and most of the cluster initiatives are aimed to help these types of companies.

Another reason for doing a study based on the annual securities report is because of its availability (Grønning, 2016, p. 21). There are no requirements for downloading the reports, and the website is both in English and Japanese. However, most of the reports submitted are in Japanese. The companies themselves can choose whether to submit a report in English or not, this means that mostly major corporations will submit an English report. The reports are easy to navigate because of the set form of the paper. Japan's Financial Services Agency has made a guideline for how to submit the reports (Grønning, 2016, p. 5). However, the language in the reports can be hard to follow at times. In some parts of the reports it is difficult to understand what they are trying to describe, especially, when they are describing their research and products. In these passages, technical terminology is being used. I will not go into how my chosen company's products work, as this is considered outside the scope of this thesis. However, it is useful to know that this company is working in a very new field of research.

More specifically, I have gone through the reports for 2011 to 2015, as well as news reports published by the selected firm, AnGes. AnGes has earlier been used in a case study by Grønning (2014) and Eyo (2015) for the period 2002 - 2012; and 2002 - 2009 respectively. This study can be considered as an extension of these studies, but with a different scope at a slightly different angle. It is worth mentioning that one of the hindrances for growth of the firm that Eyo (2015, p. 38-40) finds in her article, is an efficient drug regulatory system and lack of sustainable funding. Each report represents the previous year. In other words, a report submitted in 2016 will represent for the previous period. It sometime varies for when the report applies to, some companies follow the old reporting year, April-March. In the case of AnGes, the reports represent numbers from January 1 to December 31. I have only used the parts of the reports I considered relevant to my study. I have excluded data such as changes in stock prices. I will talk more about what parts of the reports I have used when looking for the trends in my hypotheses. For further limiting the thesis, I have chosen to focus on the submitted data concerning the submitting company (*teishutsu kaisha*). There are also numbers for consolidating company (*renketsu kaisha*). However, numbers concerning the consolidating company can be considered not to be of high interest, because numbers from subsidiary firms are included in these numbers. The numbers submitted by AnGes are considered to be of the highest interest. For the purpose to see the development of the firm, I have chosen to compare the data submitted with each previous year. As each year passes, new challenges may arrive, and what the firm perceive as important one year might change the next. This will give us an idea to what measures the firm has taken in order to accommodate these challenges. Another reason to look at reports spanning over several years, is because of the nature of this industry. It may take a very long time for products that are developed through research to be commercialized; and be to become a product the company will be able to earn money on. Therefore, it will take some time before you can see the fruits of your labour in terms of increase in income. It is interesting to see how the new products will have an impact on the performance of the firm. Since I only have data for 5 years back, there might be that we will not see any commercialized products during this time. Moreover, there might also be changes to whom AnGes decides to collaborate with. Within the annual securities reports, I have mainly been collecting data from the four first parts of the reports. Namely, company information (*kigyō jōhō*), business situation (*jigyō no jōkyō*), corporate overview (*kigyō no gaikyō*) and status of facilities (*setsubi no jōkyō*). The information in chapter 6 (case study), unless otherwise noted, is taken from the annual reports that AnGes submits to the authorities. All in all, this method I have chosen is based on using easily attainable data to look at the development of a company participating in a research-based cluster.

3.2 Hypothesis

Applying theories written about clusters, it is hypothesised that there are some markers to be found in data included in annual company securities reports and on corporate websites which reveals information about the synergies between a cluster and the companies within. Are there any characteristic trends that may be expected for firms participating in clusters? Will case studies viewed in light of cluster theories indicate whether a cluster is effective or ineffective? Which measures are supposed to have an effect on the participating companies and what performance one can expect depending on the type of industry the cluster is based on? By defining some markers for trends to look for in data from annual company securities reports and on corporate websites, the goal is to be able to provide an idea of whether participating in a cluster can be fruitful or fruitless for a company, and ultimately whether or not is makes companies more competitive and innovative.

3.3 Expected Trends among Participating Firms

Theories about clusters are almost always embedded in the idea that an area is created or emerges when all the actors and participants are working, more or less, in the same industry. This creates an environment where much knowledge can circulate and many actors can potentially benefit from it. However, each cluster has its own parameters in terms of when this is effective. Not all clusters are the same and one policy might prove successful in cluster A, whereas in cluster B it might be less effective. For the purposes of this thesis, I will examine which aspects of clusters will most likely have an effect on the participating companies and ascertain whether it is possible to find such in the annual securities reports. By looking at some theories and the research of other scholars, I can set some parameters in terms of what to expect when companies participate in a cluster. I will additionally narrow down what to expect from my findings since this thesis will research a company in a R&D-based type of industry. Therefore, the hypothesis will utilize the previous research conducted on R&D-based industries (thereby excluding manufacturing-based industry). I will list what I can expect and I will then try to provide an explanation as to why I can expect these traits. The expectations are listed below:

- the companies are innovative.

- the companies have positive growth.
- the companies were started by spin-offs, former university researchers or venture capitalists.
- the companies collaborate universities or research institutes.
- the companies are located in close proximity to research institutes, universities and related businesses.
- the companies make use of the initiatives that the cluster (organization) provides, for example, activities, subsidies, tax reduction, location and so forth.

These points represent trends that I may expect to find among companies that participate in cluster initiatives. They have been formed based on cluster theories and findings from previous research that I have considered later in this thesis (Arita et al. 2006, Collins 2008). I may also expect to find points that are a part of cluster theory, because many policies are based on cluster theory to achieve their goals. I will try to explain each of these points in more detail in the subsequent part of this chapter.

3.3.1The companies are innovative.

I would like to start by discussing the first point that 'companies are innovative'. This point is especially important for each company that involves itself in the market and wants to remain competitive, as stated by Potter (1998). However, as we have seen from the Oslo Manual (OECD, 2005) in chapter 2 about theories, there are many ways for a company to be innovative. The reason why I have set this expectation is because there is the high possibility that the company I look at will talk about their new products. The annual securities reports are aimed at shareholders, and to retain shareholders, a company will have to show that it is investing money into working on new products that might be able to raise the value of stocks when or if they are listed. Indeed, if the company in question is innovative, product innovation will most likely be mentioned in the report. However, in a business that relies on significant R&D, the products might take longer to develop in the laboratory before being marketed. The time it takes for one's product to reach the market can also depend on the kinds of prefectural or national policies on clinical trials and whether these represent a hindrance or not. Another innovation one may expect to find is process innovation. This kind of innovation might be mentioned in the reports if the company has invested money in new equipment that will enhance or change the way products are produced or developed. Such investment will be of interest as it might prove strategic for the long-term results of the company.

3.3.2 The companies have positive growth.

The next point - that 'the companies have a positive growth' - is closely linked to the first point. This is one of the main points of cluster theory; it can be easier for innovative companies to grow[2]. Given that the company is innovative, it should also become more successful and competitive. This could manifest itself in the number of employees the company has at a given point in time which can then be compared to later numbers to see whether there is an increase or decrease. In the article by Aria et al. (2006, p. 222), Jovanovic's model was used. This model suggests that age and size determine the growth of a firm. According to this model, Arita et al. (2006, p. 222) expect younger and smaller firms to have higher growth rates because of 'higher marginal labour productivity and technological innovation'. One could also look at salary spending - salaries can grow if a company is doing well, as the company has more money to spend. Offering higher salaries compared to the competition can help a company attract better or more researchers, which could again have an impact on innovation at the company. In addition, 'positive growth' can also include an increase in revenue. Changing location to a bigger laboratory or office can also be an indication of growth. Investing in new or more space may mean the company in question is looking to hire more employees or is investing in a new and better working environment for workers and researchers. There are many ways to ascertain whether companies are growing, doubtless more than I have mentioned. However, because of the scope of this thesis, it is impossible to make use of all figures and statistics to reveal whether the company I will look at have positive growth in the time periods which the annual securities reports cover.

[2] See Chapter 2 for more information on cluster theory and how innovation makes companies competitive.

3.3.3 The companies were started by spin-offs, former university researchers and venture capitalists.

Looking at the way in which the company in question started out may provide an idea of the kinds of circles and linkages the leaders of the companies have. Most likely these entrepreneurs will have ties to other people within the industry. Having contacts may help companies hire more relevant people for the R&D department or production. This point is explained well by Powell et al. (2012). In each of the successful clusters they examined, there were different reasons why more businesses emerged. In the San Francisco area, collaboration between venture capitalists and researchers led to the formation of new companies. After some time, this collaboration changed and there was more cooperation between competing firms. This was quite different to the way in which the San Diego cluster grew. In San Diego, a larger company attempted to acquire another, smaller company. However, this led to former employees of using their networks to start up their own companies. A failed acquisition led to the formation of many smaller firms (Powell et al. 2012). However, these are examples from experiences in the US, and it cannot be assumed that the same trends can be found in Japan. Arguably, however, it can be expected that those who start up new businesses will have some kinds of ties or linkages with the industry.

3.3.4 The companies collaborate with universities or research institutes.

The fourth point that may be expected to be found among companies participating in clusters is collaboration with universities or research institutes. Firstly, Porter's (1998) theory of clusters clearly states that companies in a cluster will make use of the benefits of being located close to universities or research institutes. When a company is located close to such institutes, the cost of training and recruiting new personnel will be lower and the process will be easier.

Secondly, Japan has pursued cluster formation through different policy initiatives[3]. These policies have stressed the importance of collaboration between different actors within the clusters. In addition, clusters tend to want to improve the

[3] See Chapter 4 on cluster policy in Japan.

relationship between government, academia and industry in response to the policies set out by the government. Because of these initiatives, one can expect there to be collaboration with research institutes or universities among the participants of clusters. Another reason for expecting collaboration between these types of actors consists of indications from previous research. For example, in the article by Arita et al. (2006), they found that the companies in the Kansai area valued the cooperation with universities and research institutes, saying that such cooperation was the most important factor in the growth of the company. Arita et al. (2006, p.213) also said that the main industry in the Kansai area is biotechnology. The nature of this industry is heavily dependent on R&D so it would seem fairly natural for companies related to this industry to collaborate with universities and research institutes, especially for newly established firms that cannot afford their own research laboratories. Seeding from universities is a way for companies to obtain research done at universities. This could lead to further collaboration with the university the firm obtained the seed from.

Moreover, Collins (2008) also looked at the biomedical industry within the greater Kansai cluster, and he states that (2008, p. 112) the biomedical industry is reliant on knowledge created by universities and research institutes. Companies with relations to this form of industry may therefore emerge near universities and research institutes working in the field of biotechnology. The study by Powell et al. (2012) also mentions the close relationship between companies and research institutes. In their study, they looked at the connections between the actors in the different clusters to see how these connections have developed. In Boston, they found that connections between companies and universities and research institutes were very important for the development of the cluster at its inception (Powell et al., 2012, p. 446). They also looked at the San Francisco Bay cluster. Here, initial collaboration was somewhat different, with important ties between venture capitalists and scientists. In addition, there were also universities that supported entrepreneurs. Arguably, therefore, it may be expected that many actors who started new firms and had previous ties to research institutes and universities would use their networks on establishing a start-up firm. However, early companies in the San Francisco Bay area had their roots in academic laboratories and worked a great deal together with local universities. Through this cooperation, the companies adopted academic norms of publishing and collaboration (Powell et al., 2012, p. 447-449). All these studies seem to suggest that cooperating with universities and research institutes is of benefit for firms participating in the cluster. Even if the companies have their own labs and research facilities, some sort of collaboration with a related actor can be expected. This is therefore the trend that may be found most frequently among the companies in clusters because it seems to be one of the strongest attributes of being in a cluster and contributes to the innovation rate of the company.

3.3.5 The companies are located in close proximity to research institutes, universities and related businesses.

The actual physical location of the companies corresponds closely to the definition of clusters provided by Porter (2008, p. 213):

> Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (for example, universities, standards agencies, and trade associations) in particular fields that compete but also cooperate.

According to the above, it can almost be assumed that the companies, universities, research institutes and related organizations will be in close proximity to each other, or else there would not be a clustering of related businesses. One of the benefits of being in close proximity to other related actors is more practical, in the sense of less time traveling and easier communication. Even though almost all contemporary communication takes place by email or telephone, there is a sense of belonging to a community. Another reason to be located close to other related businesses is for firms to be closer to suppliers and buyers. According to Porter (2008, p. 237) companies that are in close proximity to suppliers and buyers will gain benefits by detecting marketing trends more easily; working more closely with buyers can make firms respond more quickly to buyers' needs. This can lead to enhanced customer knowledge if a close relationship with buyers has been established.

Proximity may also allow companies to tap into the local labour pool for new, specialized personnel (Porter, 2008, p. 237). Many students and researchers might want to stay in the city, or close to where they have been studying and working for many years, instead of moving to a new area. Students and researchers may have made new friends or established a family while studying in the area, making a move more difficult and less appealing. Word of an employment opportunity may circulate more quickly if people and locations are closer, as many people in the same industry are co-located in one area and news may be spread from contact to contact. This is one of the effects, dubbed 'knowledge spillover', that cluster theories often mention as one of the strengths of forming clusters (Delgado et al., 2010, p. 497). This 'knowledge spillover' can also occur due to labour movement and experiences from earlier work can lead to new practices and the production of new information. Obtaining information about opportunities might also be easier because of all the different types of organizations that aim to help potential start-ups and established companies. This last point is closely connected to the subsequent point.

3.3.6 The companies make use of the initiatives that the cluster (organization) provides. For example: activities, subsidies, tax reductions, research institutes and so forth.

Companies can be expected to make use of initiatives provided by the cluster. Depending on how active the cluster is, many clusters seek to aid the industry which they represent. These activities and initiatives can be a part of direct actions for the cluster to achieve its goal. One such initiative may be to establish incubation organizations which can help actors wanting to start a new firm and make the task of being an entrepreneur easier. Incubation organizations can be companies that help new start-up companies to develop by providing services that increases the survival rates of the companies. These services can include workspace, shared facilities and different business support services (OECD, 2011, p. 1-3). Powell et al. (2012, p. 446-447) mention that one of the reasons that the biomedical cluster in Boston grew to be successful was because it was 'easy' to commercialize new-found knowledge, in other words, being innovative. If the relationship between industry, academia and government is close, it may be easier to change laws and regulations that might otherwise hinder innovation. Companies can often apply for subsidies through the cluster organization. Such subsidies may apply when investing in new equipment and renting facilities. Being located within special zones might also make the company eligible to apply for tax reductions. These reductions may vary, but they might for example apply for the five first years. A cluster organization will also often act as a host for numerous events and happenings. Such events may help build a community and promote the industry at large. Actors can thus often form new contacts and build networks.

3.4 Summary

The purpose of this chapter has been to draw up a methodology and hypothesis for this thesis. The methodology for the first two parts of my findings will be to use information gathered through policy documents and secondary literature to describe cluster initiatives in Japan. For the research on a single company within a cluster, I have described what kinds of trends that may be expected to be found among companies participating in clusters. These expected trends are based on theories of and previous research on clusters. Many of the trends seem to pertain to some extent to collaboration and cooperation with other actors in the related industry. Whether these trends are specific factors in success is unclear, but they may indicate the way in which firms cooperate within the context of a cluster.

4 Findings I: Cluster Policy in Japan

There have been numerous political attempts to promote clusters, varying in their goals, activities and intensities. Potter (2009, p. 29) mentions that these approaches may take the form of 'leaving the clustering process to the market, building critical mass through inward investment and infrastructure initiatives, supporting science-industry linkages and creating formal networks among cluster enterprises for joint sales and purchasing and other types of co-operation'. One of these initiatives consists of the ambitious project started by the Japanese Ministry of Economy, Trade and Industry (METI) dubbed the Industrial Cluster Project (ICP). The aim of this chapter is to provide an overview of research on clusters in Japan and the way in which the Japanese government has embraced their development through the ICP initiative.[4] I will also briefly introduce Japanese Ministry of Education, Culture, Sports, Science and Technology's (MEXT) five-year 'Basic Plan'. The second part of this chapter, I will introduce two previously done articles on clusters in Japan, namely Arita et al. (2006) and Collins (2008). Arita et al (2006) covers several different clusters, in different types of industries. Collins's (2008) article describes the formation of the biomedical cluster in Kobe.

4.1 Policies

4.1.1 The ICP

The ICP was initiated by METI in 2001. This was a programme so regional small and medium-sized enterprises and start-up companies could use research conducted at universities and research institutes to form industrial clusters. When the project commenced, there were approximately 6100 participating companies and 250 universities (METI, 2006, p.1), all of which were supposed to form network ties between the industrial and academic communities and various industries (METI, 2006, p.1). The dynamics of these clusters were supposed to provide an environment that would enhance new business creation so that the concentration of industries would expand over a wider area, revolving

[4] For a historical overview of early clustering in Japan, see Yamawaki, 2002.

around a highly competitive core industry. Such industries include information technology (IT), biotechnology, the environment and manufacturing. The aim of this project was also to enhance the competitiveness of Japanese industry (METI, 2009, p. 2). According to METI (2009, p. 2), the main reason for forming industrial clusters is innovation. Innovative companies are supposed to generate competitive products and commodities based on new technologies and ideas. This should have an impact on the economy and society as a whole. METI planned to be a factor in facilitating such regional environments.

There had been earlier attempts to increase regional innovation in Japan, such as the Technopolis Act from 1983 and the Brain Location Act from 1988 (Nishimura and Okamuro, 2011, p. 123). The aims of these policies were to generate and promote new high-tech clusters in Japan. The ICP, meanwhile, focuses to a greater extent on supporting the autonomous development of the industries that already exist, without exercising direct control over or intervening in the clustering process (Nishimura and Okamuro, 2011, p. 123). Eyo (2015, p.19) mentions that as a response to the economic crisis, Japan issued many reforms. Such as increase in R&D budgets, changes in legal and policy frameworks to encourage university-industry linkages. Because of these reforms, there was an increase of new ventures. However, the creation of new ventures decreased over the year and many companies had a hard time establishing themselves. Eyo (2015, p. 20) argues that the reforms helped establish “large number of small businesses including university spinoffs, but it did not manage to create large, sustainable, competitive companies. The ICP now mainly supports network formation between the participants in existing clusters. In addition to funding opportunities, the ICP also aids participants in obtaining information about possible contacts, such as academics and research institutes that could benefit from collaborating on projects. This is a fundamental change in the approach to cluster policy, shifting from subsidization to the facilitation of the development and functioning of existing clusters (Nishimura and Okamuro, 2011, p. 123). Nishimura and Okamuro (2011, p. 123) mention that the approach that the ICP has adopted is also similar to the approaches of successful European clusters. To support this, Nishimura and Okamuro (2011, p. 123) cite research conducted by Hospers et al. (2009) on successful clusters in Europe and their findings. Hospers et al. (2009) have found that there are several elements shared by the clusters in their research: first, clusters utilize existing regional resources; second, they gradually transform themselves according to their environment; and third, public authorities are largely absent from this clustering process. The authorities organize events to generate networks, offer technological advice and provide financial matches that aid the functioning of clusters (Nishimura and Okamuro, 2011, p. 123). The ICP seems to represent an attempt by the Japanese public authorities to adopt these approaches found in successful European clusters. One aspect that differs from the European clusters, however, is the geographical scope of each regional project. In terms of the ICP, each regional project is wider than other cluster policies. This shows that the ICP also supports network formation beyond local borders, as well as local ties. However, whether external ties are more important than internal ones is a moot point. Some findings from previous research (Oinas and Lagendijk, 2005) on clusters have shown that, in some circumstances, companies in clusters state that external cooperation is of more value than the ties they have within the clusters.

Regardless of the strength of the arguments for regional clusters that focus on local relationships, some research questions these relations, suggesting that non-local relations often comprise important components for successful economic interaction. Such research emphasizes the need to identify the way in which non-local relations may affect competitiveness (Oinas and Lagendijk, 2005, p.309).

Oinas and Lagendijk (2005) mention two themes relevant in this context. First, they stress the importance of non-local relations because the agents participate in systems that operate on a much larger scale than those of their local counterparts, in both national and international terms. Not only do they participate in the economy, but also in political, cultural, educational, national or international spheres related to natural resources, technological systems and so forth. This means that the agents are not bound by local relations, either directly or indirectly through networks. Wider environments set some of the basic conditions and directions for economic activity. Therefore, clusters are concentrated modules in a global production or innovation system, and not an isolated case (Oinas and Lagendijk 2005, p.309). Second, non-local agents can form relations beyond the cluster in order to strengthen their competitiveness - sometimes, distant friends may prove more important than closer ones. Oinas and Lagendijk argue that it cannot be assumed that close neighbours will be able to cooperate, as they might be rivals for the same market or ‘just sign up’ to participate in a cluster but not use any of the benefits the cluster may provide. This theory is also supported by an article by Okamuro and Nishimura (2011, p.724). Their findings have suggested that many of the companies in a cluster did not use any of the support systems to find new partners. Moreover, many of the companies who responded to their questionnaire emphasized linkages to partners outside the cluster. Merely participating in the cluster project produced no significant effect on the research and development (R&D) productivity of companies, but if they collaborated with national universities in the cluster, R&D productivity was significantly improved. In addition, those who had partners outside the cluster also had higher R&D productivity in terms of both quantity and quality (Okamuro and Nishimura, 2011, p. 138). This is what Oinas and Lagendijk (2005, p. 310) have identified as different actors finding it easier to relate to each other if they share similarities, regardless of distance. They also stress the diversity of actors as opposed to the homogeneity suggested by Marshall's theory[5]. Actors in different industrial fields might create more spillover effects (Oinas and Lagendijk, 2005, p.312). This means that when two different industries meet, they may find benefits from each other and subsequently a new field of research or market needs.

4.1.2 METI on clusters

According to METI (2006, p. 1), it is essential for the regions to develop self-reliant economies if Japan is to compete on the global market. This was one of the reasons for initiating the ICP. In order to make this work, the following has been outlined (translation taken from METI's report):

> ...it is important that local small and medium enterprises, universities, and public institutions should leave behind conventional one-sided vertical relationships, or situations where they stand side by side geographically, but are indifferent to one another should be left behind; that instead they should form horizontal networks that spread like webs, use their intellectual and business resources together, and promote partnership between the enterprises, universities and government agencies

[5] See Chapter 2 for notes on Marshall's theory.

> and between the businesses in order to develop business environment where new businesses can be created one after another; and that as a result, they should pursue conditions where industries are agglomerated in broader areas with those with comparative advantage as a core (the conditions hereinafter referred to as 'industrial cluster') (METI, 2006, p. 1).

We can see from the description above of the way in which METI believes that small and medium-sized companies, universities and public institutions should cooperate to form clusters that the intention of this cluster policy is for horizontal bonds to be formed between industry, academia and government. These networks are supposed to produce clusters that spawn new businesses and industries and promote regional innovation. The role of the government in this case is for agents from regional branches of METI to take a bottom-up approach. METI (2006, p. 1) mentions that ICP is different from similar programmes, where the central government's decisions are automatically applied to local communities. Since this is a bottom-up approach, the agents stationed in each region will visit 'companies and universities to grasp current situations of the region and to form networks between industry, academia and government' (METI, 2006, p. 1).

4.1.3 ICP target ranges

The ICP, which started in 2001, has set out three different targets to reach. The first term was between 2001-2005. The focus in this period comprised the starting up of the ICP and clusters. METI did this by launching approximately 20 ICPs. The project emphasized the need for forming networks between companies, universities and government agents, but especially also the need to form 'networks in which each face is visible' to provide a foundation for the cluster (METI, 2009, p. 3). In this period, the government played a central role in promoting the ICP by looking at existing clusters and policy needs (METI, 2009, p. 3).

The second term was set for 2006-2010. Its aim was to continue the creation of network ties between companies, academic institutes and research institutes. However, during this term, specific businesses were also supposed to be developed (METI, 2009, p. 3). According to METI (2006, p. 1), after the transition from the first term to the second term, each regional cluster was then supposed to have enough information about its industrial capabilities so cluster plans could be changed, reconsidered, reorganized or integrated. Shifting to the second term also witnessed a decrease in the total number of cluster projects, from 19 to 17. Five projects were discontinued, three were adopted, nine were modified and five continued (METI, 2006, p. 12). As well as developing specific businesses, during this term corporate management was supposed to be promoted as well as the creation of start-up companies. One of the numerical targets set during this term was for a total of 40,000 new businesses to be launched (METI, 2006, p. 12). To achieve these goals in the second term, METI provided eight different types of support, including support for network forming, sophisticating networks, R&D, the development of new markets, funding, human resource development, cooperation with business incubation and the mutual application between local governments of their policies and measures (METI, 2006, p. 20-23).[6] The third and last term was set for 2011-2020. There has been a focus on the additional promotion of the formation of networks and the development of specific businesses, like in the previous terms. By reaching this stage of the project, the clusters are expected to experience autonomous growth. We are now well into the last term of the ICP. The project has now shifted to the 'autonomous growth period', meaning that the cluster activities are now performed by local governments and private organizations, instead of the ICP promoting and helping start up new clusters, compared to the previous stages of the ICP (METI, 2009, p. 3). At the time of writing, I am not aware of any reviews or research into the results of the last term that have been released in English.

4.2 Science and Technology

In addition to the ICP, there are also initiatives by the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT). MEXT also has a policy to promote science and technology so Japan can remain competitive in the global economy. To achieve these goals, MEXT has a basic plan for basic policies and laws on science and technology, which consists of plans to promote R&D, and coordinates government agencies in relation to promoting science and technology. This basic plan

[6] See METI (2006) for more detail about each of these forms of support.

includes policies aimed at forming knowledge clusters. This part of the chapter will thus briefly introduce such plans and efforts promoting regional clusters.

4.2.1 Basic plans

The basic plans for promoting science, technology and innovation policy initiated by MEXT are quite similar to the ICPs of METI, as both the initiatives and the policy-making involve several stages. The ICP has three different stages and is currently in its last phase, with each cluster supposed to be autonomous; however, MEXT's basic plan is arranged somewhat differently. Five basic plans have been published, the latest of which was released in the fiscal year (FY) of 2016. The basic plan has been prepared by the Japanese government to promote science and technology in the country over a five-year term (MEXT, 1996, p. 1-3).

The first was initiated in FY 1996 and lasted until FY 2000. Its aims were 'to radically improve the environment so as to upgrade the R&D abilities of industrial, academic, and governmental circles; to formulate and carry out policies to make the best use of such improvements; and to facilitate all achievements for use by the public, society and economy' (MEXT, 1996, p. 2). This would also include the promotion of science and technology in the regions.

The second basic plan picked up where the first one left off - it continued until FY 2005. In short, this plan had a greater focus on creating and improving an environment for the promotion of science and technology in the regions. This plan shifted towards more focus on the regions - this was shown in the formation of the 'knowledge cluster initiative' (MEXT, 2001, p. 37).

The third basic plan started in FY 2006 and lasted until FY 2010. This plan was very much like the previous one, focusing on the regions and facilitating the promotion of science and technology policies there. The promotion of cluster formation in the regions would continue to be promoted. In addition, this plan also emphasized the establishment of regional innovation systems and the revitalization of local communities (MEXT, 2006, p. 44).

The fourth basic plan lasted from FY 2011 to FY 2015 and the focus changed to some degree. This policy was also supposed to promote science and technology in the regions. However, the new policy would also include ‘innovation’. To include the new focus on innovation, METX changed the name of the policies to include innovation. These policies are now called ‘science, technology and innovation’. In addition, there was a shift towards an emphasis on network-building within the regions. This new policy aimed at establishing more collaboration between universities, industry and government, as well as establishing places for such interactions, where knowledge could be exchanged between different actors in the region (MEXT, 2011, p. 6-13).

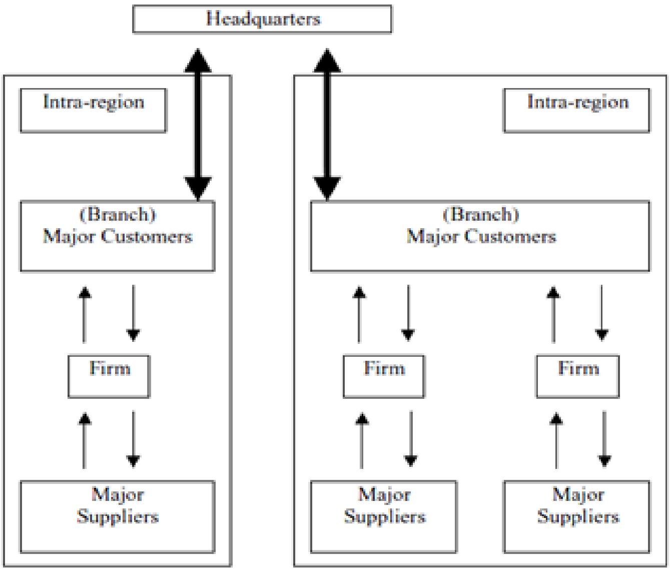
The relatively newly released fifth basic plan will last from FY 2016 to FY 2020. This plan was formulated by the Council for Science, Technology and Innovation and focuses on enhancing science, technology and innovation. Like the previous plan, it encourages actors in a region to work together, and especially government, academia and industry, to help make and transform Japan into the ‘most innovation-friendly country in the world’. This new plan aims to make Japan more amenable to change and calls for more flexibility and diversity. It also wants Japan to be forward-thinking and to take correct, strategic actions. There are four pillars on which this plan is based: ‘i) acting to create new value for the development of future industry and social transformation; ii) addressing economic and social challenges; iii) reinforcing the fundamentals of science, technology and innovation; [and] iv) establishing a systemic virtuous cycle of human resources, knowledge, and capital for innovation’ (MEXT, 2016, p. 8-10). A new point in this plan is that to achieve these goals or pillars, the basic plan mentions that it is essential to cooperate to a greater extent internationally (MEXT, 2016, p. 1).

4.3 Previous Research on clusters

This part of the chapter will examine previous research on clusters in Japan to provide some insight into how such clusters operate there. First, I will look at a study by Arita, Fujita and Kameyama (2006). It used data collected from a questionnaire covering three different clusters in Japan, all situated in different regions. They have looked at the horizontal networking between actors within the respective clusters. Second, I will examine a study by Collins (2008) which took an empirical approach to the formation of a biotechnology cluster in the city of Kobe. He starts by discussing the devastation wrought by the major earthquake that hit the area in 1995, mentioning that this was one of the reasons the city pursued the formation of a cluster there. This provides insight into a cluster that was intentionally formed by the government and supporting actors.

4.3.1 Cooperation among actors in a cluster

In their study, Arita, Fujita and Kameyama attempted to 'analyse the effects of intra-regional horizontal cooperation among small and medium-sized firms of manufacturing, biotechnical industry, and informational industry using a data set from a questionnaire covering three major industrial clusters in Japan' (Arita et al., 2006, p. 209). Furthermore, they mentioned some earlier works on clusters, such as Saxenian (1994), that suggest that for there to be sustainable development of an industrial cluster, there is a need for local, horizontal and flexible inter-company relations between the participants of the cluster, rather than the vertical relationship that is often found among large enterprises and smaller firms (Arita et al., 2006, p. 210). Arita et al. used data from a questionnaire to identify the contents of the various forms of cooperation between companies. This also included the kinds of partnerships and styles of these forms of cooperation in the specific clusters. In addition, Arita et al. used the data collected from the questionnaire to look at the cooperative activities in two ways: 'i) the types of regional cooperation at the three production stages of research and development (R&D), commercialization, and marketing, and ii) the categories of alliance partners' (Arita et al., 2006, p. 210).



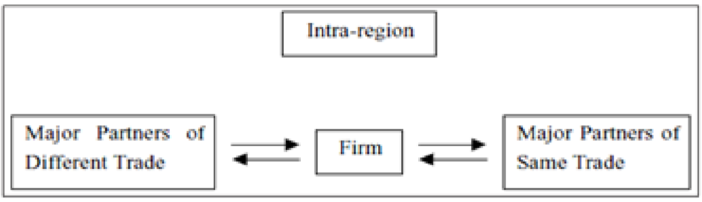


Figure 4.1 and **Figure 4.2:** The figures show intra-regional cooperation and horizontal cooperation (Source: Arita et al. 2006 p. 211, figure 1. And figure 2.).

Arita et al. mention that the main type of cooperation within Japanese industrial agglomerations is vertical (see figure 4.1). However, they also mention as a hypothesis that horizontal cooperation as shown in figures 4.2 above and figure 4.3 below, with major actors within and outside of their own trade, as well as interactions with universities, public research institutes and cross-industry exchange organizations, was on the rise to promote the growth of companies 'through agglomeration economies of knowledge externalities' (Arita et al., 2006, p. 210).

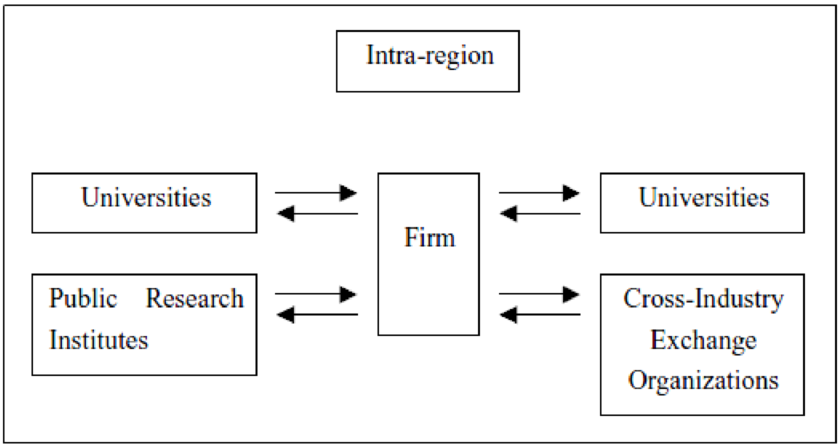


Figure 4.3: Horizontal cooperation, industry-academia-government cooperation (Source: Arita et al. 2006, p. 212, figure 3.).

Their paper was organized first by introducing the questionnaire and its background. Then they present the status of the three different clusters in question, namely Tama (manufacturing), Kinki (biotechnology) and Hokkaido (information technology). They then analyse the effect of the regional inter-company cooperation by estimating firm growth.

The questionnaire was conducted by METI in 2002, approximately one year after METI started the ICP as a means to develop industrial clusters in Japan. Arita et al. (2006, p. 212) mention that the usual way companies related or cooperated was through *keiretsu* (affiliation) type relations. Thus, there was a vertical inter-company relation with stable transactions, but there were difficulties in globalization. The three clusters did form organizations for cooperation between government, industry and academia before the launch of the ICP. The three clusters were selected to see the impact of the policy implementation through the ICP (Arita et al., 2006, p. 212).

The survey was distributed to 1051 companies in Tama, 1025 companies in Kinki and 918 companies in Hokkaido. The number of company responses was as follows: 205 in Tama, 210 in Kinki and 194 in Hokkaido (Arita et al., 2006, p. 212). Arita et al. used only portions of the questionnaire relevant to intra-regional cooperation. The companies that responded to this questionnaire were given the option of answering how often they cooperated with different types of partners. The industrial cluster in Tama consists of manufacturing companies located in the western part of the Tokyo, Kanagawa and Saitama prefectures. The main industries of Tama include industrial and telecommunications machinery. The Kinki cluster consists of companies from Osaka, Kobe, Hyogo, Nara, Wakayama and Fukui prefectures. The main industry of Kinki includes the biotechnological industry. Lastly, Hokkaido's main industry is information technology (Arita et al., 2006, p.213). As we can see, in each area where the questionnaire was conducted, there were different main industries. This might produce different results in the questionnaire, as some industries may find it more appropriate to cooperate with others at different stages of production. The questionnaire differentiates between the production stages, R&D, commercialization and marketing. Arita et al. (2006, p. 214).

From these comparisons, Arita et al. (2006, p. 216) have revealed that the most common alliances were between 'major suppliers' and 'major customers'. However, the Tama cluster cooperated with 'major customers' and 'major suppliers' during all three production stages. The Kinki cluster had some cooperation with 'universities' and 'public research institutes' during the first stage, which was related to R&D. In addition, Kinki also cooperated with partners such as 'trade and industry associations', 'cross industry exchange organizations', 'public supporting organizations' and 'incubation facilities' during the first stage. This means that companies in the Kinki cluster may have benefited from diversified cooperation partners of the horizontal type. The Hokkaido cluster demonstrated cooperation with 'major partners of same trade', 'major suppliers' and 'major customers' during the first and second stages (commercialization). During the first stage, Hokkaido demonstrated cooperation with 'cross industry exchange organizations', 'universities' and 'public supporting organizations', especially during the first stage (Arita et al., 2006, p. 216-8). There was more cooperation with 'universities' and 'public research institutes' during the R&D stage for Kinki and Hokkaido, compared to Tama. Arita et al. (2006, p. 218) suggest that this is because of the nature of these two industries which are different from the one in Tama.

To determine the growth of a company, Arita et al. (2006, p. 218-25) first looked at the internal factors, which are the age and size of the company - these factors are also determined by sales growth - and then they added the external factor, which was regional cooperation. They utilized a model based on one proposed by Jovanovic; the latter states that a company's growth is inversely related to its size and age (Arita et al., 2006, p. 222). From this model, they revealed that internal factors worked more strongly for companies in Kinki. However, this study done by Arita et al., examined the effects of external factors and the effects of regional cooperation, so they added the external factor to their model. This means that they looked at each stage to see where cooperating partners had an effect on the growth of the company. When adding this factor to the equation, the following is shown (Arita et al., 2006, p. 225):

Table 4.1: Most effective cooperation for company growth, in each region**.**

Stage	Tama	Kinki	Hokkaido
A Research and development	- Cross-industry exchange organization	- Universities - Research institutes	- None
B Commercialization	- Cross-industry exchange organization - Supporting and incubations facilities	- Universities - Research institutes	- Major customers
C Marketing	- Major customers - Cross-industry exchange organization	- Major partners of different trade	- R&D organizations

*I have put together this table consisting of Arita et al.'s findings to make it easier to understand the difference between each industry.

From this, Arita et al. (2006, p. 226) have concluded that even though vertical cooperation, for example in the form of 'major suppliers' and 'major customers', is still important in each of the three clusters, these are not the main factors for company growth, as shown in table 4.1. This, they maintain, contradicts previous research that stresses the importance of vertical cooperation (Arita et al., 2006, p. 226). There was also no significant degree of cooperation with 'major partners of same trade' or 'major partners of different trade'. This might show that the companies in these clusters might not enjoy urbanization economies arising from a variety of industrial agglomerations (Arita et al., 2006, p. 226). In addition, depending on the dominant industry, there will be different forms of partnership during each of these production stages.

Arita et al. reveals many interesting findings, and to some extent it confirms many of the benefits of being in a cluster that theories posit. However, some parts of this article may have been placed in too broad a context. For example, it might be more fruitful to look at more concentrated areas/clusters. Even though the clusters in their article do have dominant industries, it may be more fruitful to conduct research on same industries in different clusters. It cannot be assumed that a company in one industry - for example biotechnology - will demonstrate the same partnership pattern as another company in the same industry but in a different region. One could also argue against conducting a survey only one year after the start-up of the ICP. In addition, the timing of the survey – in the case for biotechnology – is very early, compared to the other industries with other, old industries as manufacturing and IT being newer but still considerable older than the Kinki biotechnology. Depending on what position the person in the company who received the questionnaire had, they might not even know that the company is participating in a cluster, since the ICP had only started out the previous year. The participation in the cluster may not have been official among its employees. As many of the theories state that clustering is a long-term process that could take decades to accomplish, conducting a survey to examine the effects of cooperation after just one year could be meaningless. Arita et al.'s research could give us an idea of where to focus efforts for collaboration and where one should work for more cooperation to be more effective.

4.3.2 The formation of the biomedical cluster in Kobe

In this research paper, Collins (2008) looked at the biomedical cluster initiated in Kobe. This was a case study designed to show how the cluster came into being. This cluster is a part of the biomedical industry which is highly reliant on obtaining new research and knowledge through universities and research institutes. Companies involved in this industry tend to emerge in close proximity to universities and research institutes because of the nature of the industry. Collins (2008, p. 111-112) mentions that one of the reasons for the investment in a biotechnological cluster was the revitalization of the economy in Kobe after the destruction caused by the earthquake in 1995, which left Kobe's economy in ruins. Collin's case study tries to answer the following questions: 'How did it happen, and why? What did policy makers do right, and wrong, in the process? Are Kobe's achievements sustainable? What lessons, if any, does Kobe's experience hold for other regions' (Collins, 2008, p. 111-112).

Collins (2008, p. 112) begins by discussing the historical background of Kobe, as it has been one of Japan's most important harbours and an important producer of Japanese rice wine. He then discusses the disastrous earthquake that took place in 1995 (Collins, 2008, p. 113). More than 122,000 structures fully or partially collapsed, and approximately 6965 were consumed by the fires that broke out. As many as 6400 people also perished (4571 of these were Kobe residents, and almost 15,000 people were injured). There were enormous economic consequences. It is estimated that 6.8 trillion yen of capital stock was wiped out instantaneously. This was more than the city's gross domestic product (Collins, 2008, p. 113). Furthermore, the damage to infrastructure was also immense, making the path to recovery long and hard. In addition, Japan was also struggling in the late 1990s, recovering from the post-bubble period, when economic growth was stagnating, which could also be seen in the trend for the number of business establishments and employment in the city of Kobe (Collins, 2008, p. 113). However, in 1996 the World Health Organization (WHO) opened its Centre for Health Development in Kobe, as one of two WHO global research institutes. Kobe could thus become a centre for research related to health and urbanization; it also gave Kobe an opportunity to focus on health care, as Japan was also facing a rapidly aging population (Collins, 2008, p. 113).

After this brief introduction to the historical background of Kobe's past, Collins then discusses the measures Kobe initiated to revitalize its economy. Almost immediately after the earthquake, Kobe's biomedical industry has its origins in two policy decisions taken by the municipal government (Collins, 2008, p. 114). The goal of the municipal government was to have full economic recovery by 2005, and one of the key elements to do this was to develop the southern part of Port Island (Collins, 2008, p. 114). Port Island is an artificial one located in Osaka Bay, not far from the main city and has good accessibility. The main industries on the island were steel, shipbuilding and transport, but the new part of the island houses Kobe Enterprise Zone, a China-Asia Trade Zone and a multimedia information and communication centre (Collins, 2008, p. 114). Establishing business on the island was made easier by establishing tax incentives and subsidies for rent and loans. By providing these benefits, start-ups on this artificial island were supposed to be made more attractive. Because of the establishment of the WHO research centre, the government wanted to persuade the research centre to become a core hub for a new health and welfare industry to support the aging population. The new project to develop Kobe as a centre for the biomedical industry was unveiled in 1998 and was dubbed the Medical Industry Development Project, with the plan being to develop this industry into one of the cornerstones of the region's future economy (Collins, 2008, p. 114). Kobe was known for its heavy industries, such as mechanical and steel industries, so this new plan was intended to change this structure to be more reliant on the biomedical industry, which would include biomedical equipment and cutting-edge medical therapies. The intention was to get more small and medium-sized companies and foreign firms to settle in Kobe. These companies could make use of the benefits of subsidies and other incentives associated with the development of Port Island (Collins, 2008, p. 115). In addition, the New Industry Research Organization (NIRO) was established the year before to foster more collaboration between research institutes, universities and government in the region. NIRO was encouraged to assist the city's small and medium-sized companies enter the biomedical industry (Collins, 2008, p. 115). Around the same time, a working group was established consisting of the director of Kobe City General Hospital (the former president of Kyoto University), directors of the medical teaching departments at Kyoto, Osaka and Kobe Universities, as well as government officials from Kobe and Hyogo prefectural government and the head of the Kobe Medical Association. Officials from the ministries of health and welfare and trade and industry were observers. This working group was charged with proposing a detailed plan for this development (Collins, 2008, p. 115). The working group's vision was to aim higher than just revitalizing the city's economy; it aimed for the city to be one of the global leaders within biomedical technology. Furthermore, it aimed to raise the quality and technological sophistication of Japan's entire medical system (Collins, 2008, p. 115). With this rather bold goal, the group wanted to tap into the resources that already existed in the Kansai region, since Kobe city did not have any industry related to biomedical technology. Kobe would try to achieve these goals by tapping into resources at Osaka, which is renowned for its biomedical research at Osaka University and for being a centre for the Japanese drug industry, and using Kyoto University's capabilities within developmental biology and regenerative medicine. In addition, the city would use its links to foreign companies and trade links with Asia (Collins, 2008, p. 115). By using these connections, the group proposed a set of interlinked organizations and operating principles to build a medical system that focused on 'translational research' (Collins, 2008, p. 115). Translational research can be defined as research which makes it easier for new and better treatments and technology from laboratories and research institutes to benefit patients.

Because of the ties to Kyoto and Osaka, as well as national projects, the research that would be emphasized in Kobe would be regenerative medicine and medical devices associated with diagnosing and treating cancer (Collins, 2008, p. 116). According to Collins (2008, p. 116), the project set up different organizations that would deal with three core functions. First, some organizations would deal with research. Second, another organization would deal with the development of businesses to commercialize the research conducted in new and existing businesses. Third, there would be an organization that would deal with the training of personnel required to perform translational research and commercialize the results (Collins, 2008, p. 116). The organizations with these core functions had offices at Port Island. Biomedical Research and Innovation (FBRI) was established in 2000 to manage the project at Port Island. It was not until 2003 that the core research facility, the Institute of Biomedical Research and Innovation (IBRI), was finished; it would house the research for medical devices, clinical research for new drugs and the clinical application of regenerative medicine. These facilities were equipped with state of the art equipment, laboratories and examination rooms (Collins, 2008, p. 116). Situated right next door and also connected physically to IBRI, there was the Translational Research and Informatics Centre (TRI). The main tasks of TRI were to provide planning, administrative, data management and analytical support for clinical trials associated with the research at IRBRI and companies associated with the project (Collins, 2008, p. 116). MEXT and Kobe city shared the cost of building this centre. As for the last core function of the project, there were the facilities for business development and training. Kobe Biotechnology Research and Human Resource Development Centre, which is co-located with the Kobe University Business Incubation Centre, sponsors programmes to train medical personnel and researchers (Collins, 2008, p. 116). In addition to these facilities mentioned above, there are several different facilities nearby that house various functions to benefit industry and small and medium-sized companies. Collins (2008, p. 117) states that all of this was possible because of the subsidies and government support that the biomedical industry received. One of the reasons that this ambitious project received such support was because of the launch of a new science and technology policy framework in the form of the government's second basic plan, which spanned from 2001-2006. This plan increased national spending on science and technology to 0.8% of GDP. The framework was to commit more funding within four priority areas, namely life sciences, information technology, nanotechnology and materials, and the environment. Furthermore, it also emphasized the regional context by increasing funding for economic revitalization through collaboration between local government, industry and universities. The basic plan stressed four points: the increased mobility of researchers between universities, industry and government; improving the environment for technology transfer from universities to industry; promoting the commercialization of publicly funded R&D; and, to improve the support for start-up companies (Collins, 2008, p. 117). Not only did the biomedical industry project in Kobe benefit from the basic plan, it also gained more support from the ICP launched by METI in 2001. Moreover, the 'knowledge initiative' was launched a year later. The ICP fostered networking between universities, regional government bodies and industry within the regional districts of Japan. The knowledge initiative helped clustering for knowledge-based industries with close ties to universities and research institutes, and integrated these institutes more closely with the local economy (Collins, 2008, p. 118). Collins (2008, p. 118) mentions that these projects and initiatives did not grant very much money to the Kobe biomedical technology cluster. However, the value of these initiatives conducted by the government lay in all the networking opportunities and coordination activities across organizations and sectors that had historically been isolated from each other. Such cross-cutting meetings might provide space for new research areas and collaboration that would not have been possible if such forums did not exist. The clusters in the area were expected to collaborate under a bigger, regional cluster called Kinki Wide-Area Cluster (Collins, 2008, p. 118).

In the last part of his article, Collins (2008, p. 118) looks at the assessment of the Kobe Biomedical Industry Development. He then answers the following questions: 'Is the Kobe project achieving its objectives? Is it returning value to its stakeholders and constituents at least as great as the costs that have been invested in it to date? Has it reached a point where it can be self-sustaining, without further injection of public funds?'(Collins, 2008, p. 118-119). To the first question, Collins' answer is unequivocally positive. The Kobe project has turned the city into one of the leading centres for research and translational medicine in the fields of regenerative medicine and the combined diagnostic and therapeutic use of medical equipment. When his article was written in 2007, there were 101 companies in relation to the industry. 49 were start-ups, 25 were local operations of large firms and 27 were medium-sized. In total, 2690 new jobs were created, including 593 at 75 different biomedical-related companies with a presence in the area. In addition, there were 610 jobs at three core research institutes on Port Island (Collins, 2008, p. 119).

To the question whether the project has generated a satisfactory return on investment and whether it has created value for taxpayers, Collins (2008, p. 119) is uncertain as this project had cost large sums of money for both central and local governments. In order to attract start-up companies and other actors to Port Island, many subsidies and tax reductions of up to 50% had been provided (Collins, 2008, p.118). Many feared that this may create an environment and culture where companies become dependent on these benefits, while anticipating their continuation. The possibility that subsidies might be phased out was of great concern to life-science companies involved in the project (Collins, 2008, p. 120).

As to the last question about self-sustainability, Collins (2008, p. 120) says that it is too early to tell because regional industry clusters have to evolve over a long period, in some cases many decades. Furthermore, Collins (2008, p. 120) states that many of the companies within the cluster are overly dependent on the subsidies, with some operating ‘in the red’.

As a conclusion, Collins (2008, p. 121) mentions that this is an example of a top-down approach to forming a cluster because it was conceived of and driven by a very small group not consisting of private entrepreneurs and companies. Indeed, the presence of individuals was one of the reasons for the success and formation of the cluster, as they were able to give advice and the city was willing to try to adopt these ideas. Collins (2008, p. 121) also mentions that there is no ‘go to method’ or ‘one-size-fits-all approach’ when it comes to industrial cluster formation or policies. Each approach has unique traits that need to be tailor-made. To sum up, Collins’ article provides an interesting picture of a cluster that has come into being because of individuals and a willingness by local policy makers to strive for its existence. One of the most important questions about sustainability could not be answered, but there are perhaps reasons to be optimistic that this could work in the long run.

4.4 Summary

In this chapter, I have presented my findings on cluster policy in Japan. In addition, I have used secondary literature to help describe different clusters in Japan. The chapter started out by describing the ICP initiated by METI in 2001. It was an initiative for increasing the competitiveness of the Japanese industry by encouraging collaboration among firms and academia. The initiative also took an active role to create and to remove clusters. The initiative also stressed the importance of horizontal collaborations among the actors. The initiative is in its final phase, where autonomous growth is expected, shifting the cluster activities over to local governments and private organizations, instead of having the ICP to help promoting and starting up new clusters, as was the goal of the previous phases of the initiative. The chapter has also briefly touch the 'Basic plan' issued by MEXT. The second part of the chapter used previously done research on Japanese clusters. Arita et al. (2006) findings revealed when and what kind of collaboration firms considered important. Their study also included different types of industrial clusters. Lastly, Collins (2008) described the formation of the biomedical cluster in Kobe. This article showed us that key people may be an important factor for a cluster's survival.

5 Findings II: Chosen Cluster

The purpose of this chapter is to examine the cluster chosen for this thesis, namely the Osaka Bio Headquarters (OBH). The company I am sampling by data from is a member of this cluster. I will briefly introduce the formation of the cluster and present the various actors that take part in it. I will also examine its goals as this may shed light on whether they transfer over to the company I have chosen to research.

5.1 OBH and Northern Osaka Biomedical Cluster

5.1.1 Location

The location of the cluster may be important as it may indicate why a biotechnology cluster has emerged or been created in this particular area. Osaka is located in the Kansai region and is the regional capital; it is one of the biggest cities in Japan and an important economic hub. As a centre for commerce and industry, Osaka enjoys good transport systems, easing accessibility to the city, such an infrastructure may make Osaka a prime spot for setting up businesses. As for the cluster, itself, two main areas in the city have become centres for biotechnology. These are Saito, located in the north of the city, and Dosho-Machi, located more centrally. These two areas offer different background stories about the way in which they became associated with biotechnology. Dosho-Machi, for example, has been a hub for medicine since the Edo era (1603-1868). This part of town was known as ‘Medicine Town’ in the Edo era and attracted materials for medicine products (OBH, 2015, p. 5). Today, there are over 300 companies associated with the biotechnology industry in this area, with major corporations such as Takeda Pharmaceutical Company Limited, Mitsubishi Tanabe Pharma Corporation and Dainippon Sumitomo Pharma Co. Ltd. One might say that this particular area emerged *by itself* to become a cluster for biotechnology-related industry. Saito, on the other hand, is a project devoted to a greater extent to attracting and creating an environment for actors related to the same industry.

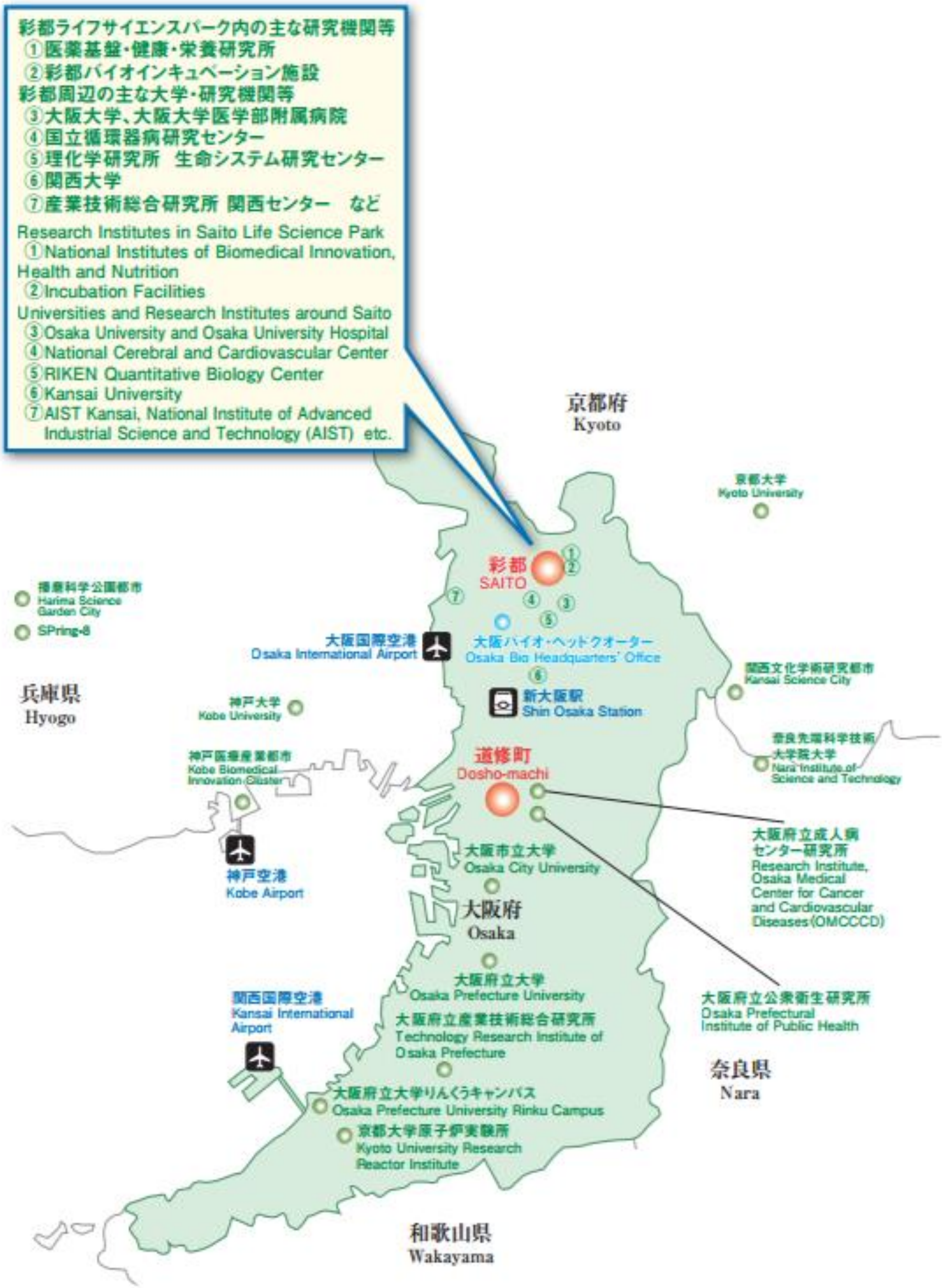


Figure 5.1: Map over OBH (Source: OBH, 2015, p. 3)

The Saito Life Science Park opened in 2004 and is a designated spot for the accumulation of companies, research institutes and universities for the life sciences. In particular, it accommodates facilities for research and technology. As of 2015, there were over 1500 researchers working in the Saito Life Science Park (OBH, 2015, p. 14) Moreover, there are governmental initiatives encouraging more cooperation between government, industry and academia in this area. Osaka is also known for its industry and manufacturers within other types of industries, which could help trigger the creation of new types of businesses, as mentioned in earlier chapters in the present thesis. Not only do the industries occupy strong positions in the area, there are also many research institutes and universities located in the city, close to the two areas mentioned, as shown by Figure 5.1 above.

5.1.2 History

Osaka's strong links to medicine (Medicine Town) and other industry (manufacturing) may make it seem an ideal place for actors who are interested in the growth of the biotechnology industry by combining traditions in medicine and manufacturing. Actors in the Osaka area saw an opportunity to utilise resources already present. OBH was the initiative responding to Osaka prefectural government's launch of the Osaka Bio Strategy in 2008; the main goal of this strategy was to make Osaka a world-class site for the biotechnology industry by the year of 2018. To do so, there was a call for a strategy that involved industry, government and research institutes. Indeed, this was also the goal of the Knowledge Cluster initiative launched by MEXT. These different types of actors consist of two organizations, namely the Osaka Bio Strategy Promotion Conference and the Osaka Bio Support Group. The former consists of leading industrial, academic and governmental organizations; the latter consists of members who work with frontline industries and biotechnology in Osaka. The difference between these organizations lies in the fact that the Osaka Bio Support Group advises on activities at OBH. They are supposed to advise and suggest cooperation activities for OBH. This could include planning and disseminating information. The Osaka Bio Strategy Promotion Conference consists of top leaders of major companies and academic and governmental organizations (see Table 5.1 for a list of members). They are in charge of deciding which directions the Osaka Bio Strategy should head towards. To reach their goal, the achievements of the initiative are assessed annually.

Table 5.1: Members of Osaka Bio Strategy Promotion Conference as of August 2015 (Source: OBH, 2015, p. 17).

National Institutes of Biomedical Innovation, Health and Nutrition	Osaka University
Osaka Pharmaceutical Manufacturers Association	Osaka City University
Osaka City	Kansai Bureau of Economy, Trade and Industry
Osaka Prefecture	National Cerebral and Cardiovascular Centre
Osaka Chamber of Commerce and Industry	Senri Life Science Foundation

5.1.3 Osaka Bio Strategy

The Osaka Bio Strategy consisted of six main points outlining how the biotechnology industry in Osaka could be aided. The first of the six points was to set a main goal for the initiative. Osaka was to become one of the world's foremost areas for the biotech industry within ten years. The second point was to utilize the strengths already present in the city. By using the previously established cooperation between different actors, such as industry, academia and government, further activities by research institutes could be promoted. These activities could help lead to the greater development of advanced drugs. In addition, with more activities, new forms of collaboration between actors could be established. The third point was dubbed 'solving problems', implying facilitating the easier operation of biotech-related companies. This could be implemented by making clinical trials and new drug application processes more efficient. In other words, it would be easier to get one's product on the market. This would in essence make it easier for new biotech ventures to survive the competitive environment with major corporations. This would also encourage the generation of new biotech ventures. To make these changes, subcommittees were set up to work on each of these measures. The fourth point was to secure continual growth. This could be implemented by expanding alliances beyond Japan on an international scale. Japanese companies could thus be helped to form business links with foreign biotech-related clusters. The fifth point was to 'improve the environment'. This would involve developing infrastructure in the city to make Osaka a more attractive location to set up a business. Such as making it easier for different sized companies to settle or expanding their business. The sixth point involved 'measuring achievements'. This could be done by looking at how the cluster had grown and the effectiveness of strategies. There were several ways to measure this, including looking at the number of businesses, the amount of investment, the number of new drug applications that had been filed and so forth.

It is interesting to see how the strategy changed the year after its formation. In 2009, The Osaka Bio Strategy added more concrete strategies for reaching goals. The first strategy would then also include strengthening venture support through something called the Osaka Bio Fund. This fund would help finance more venture projects. A service would also be established for ventures that could help them get in touch with people with high levels of expertise. Lastly, incubation centres would be established to support start-up companies. All these strategies can be placed under the umbrella of financial support, recruitment support and management support. An additional strategy was supposed to help accelerate the development of new medicines and devices. This involved a new system for accelerated clinical trials at various prefectural hospitals and the prefectural reform of regulations pertaining to medical trials. Another strategy called for encouraging innovative researchers by promoting the Knowledge Cluster Initiative and a consortium for developing cutting-edge technology. This strategy would also include the development of research centres by promoting regional research centres in collaboration with government, academia and industry (cf. Table 5.2 for a list of institutions and organizations in the OBH) and having centres for global collaboration. Lastly, the fourth strategy calls for promoting alliances, whether domestically or internationally. One such alliance is the EU-Japan Centre for Industrial Cooperation. An example of a domestic alliance is the Protein Mall Kansai which involves R&D collaboration for companies and organizations in Kansai that work with protein. These points and strategies, as mentioned above, would of course change over the course of a ten-year goal to be a world class bio industry. 'Osaka Bio Strategy' has set as its deadline to become a 'world class bio industry within 2018.

Table 5.2: Institutions and organizations in OBH (Source: OBH, 2015, p. 5-17).

Universities (3)		
Osaka Uni.	Osaka Prefecture Uni.	Osaka City Uni.
Research Institutes and Hospitals (7)		
The Research Institute for Microbial Diseases (Osaka Uni.)	Institute for Protein Research (Osaka Uni.)	Osaka Uni. Hospital/ Future Medical Centre
Immunology Frontier Research Centre (Osaka Uni.)	National Cerebral and Cardiovascular Centre	National Institute of Biomedical Innovation, Health and Nutrition
Riken Quantitative Biology Centre		
Related Organizations (12)		
Kansai Bureau of Economy, Trade and Industry (METI-KANSAI)	Osaka Chamber of Commerce and Industry	Osaka Pharmaceutical Manufacturers Association
Senri Life Science Foundation	NPO Kinki Bio-Industry Development Organization	Osaka City Government
Saito Bio Innovation Centre	Saito Bio Hills Centre	Saito Bio Incubator
Pharmaceuticals and Medical Devices Agency (PMDA)	Osaka Medical Equipment Society	Urban Innovation Institute

5.1.4 Subsidies

Becoming a member of the cluster seems to offer benefits as there are several measures in place to help start-up companies and other long-term members through subsidies and cheaper rents on facilities. Such subsidies aids in the effort to making the concentration of bio-related businesses in close proximity to each other. One can receive subsidies in Saito if one’s company is small enough (fewer than 50 employees or less than 300 million yen in capital) for up to five years. Osaka prefecture also promotes a tax system to encourage the cluster formation of industries. One of these systems reduces real-estate taxes. In addition, there are specialized zones for such tax reductions, especially assigned to growth. Moreover, it is possible to receive subsidies for equipment in Saito Life Science Park. These are just some of the benefits from moving or starting up a biotech business in the area (Osaka pref., 2016).

5.2 Summary

In this chapter I have looked briefly at the biomedical cluster in Osaka. Osaka has a long history of involvement in the medical industry in Japan. Today, Osaka builds upon this tradition by setting up initiatives for the generation of new biotech-related businesses. One of these initiatives is the Osaka Bio Headquarters, where actors from government, industry and academia can participate and have a say in how the biomedical industry in Osaka should evolve. Bio-related companies can benefit from the close ties to world-class universities and research institutes in the life sciences. In addition, Osaka prefectural government has a policy to attract new biotech ventures and encourage established companies to relocate to the city. Tax reductions and subsidies are also offered to attract start-ups.

6 Findings III: Company research

The purpose of this chapter is to present the findings of a case study done on a company participating in a cluster. The information gathered on the company is based on annual securities reports and news releases posted on their company website. These are mandatory reports for businesses that are registered on the stock market, either in Osaka or in Tokyo, aimed to inform the authorities about the state of the firm. A more thorough description will be given later in this chapter. As these reports are submitted every year, these might be able to give us an idea on how the companies are evolving within the context of being a part of a cluster. I will also give a short overview of the firm that I am going to look at and that participate in the 'Osaka Bio Headquarters' initiative. Namely, the company called AnGes MG. An introduction to the background of the firm will be given prior to the presentation of the results of the analysis. Then there will be a section on what kind of findings I have found from the data within the selected reports. What I am looking for in the data in the reports will be defined on the trends that I have found in the hypothesis.

6.1 An overview of AnGes

AnGes was founded in 1999 based on a discovery by researchers working at Osaka University. With less than 70 employees, AnGes is small company located in Osaka. AnGes is engaged in developing medicine for gene therapy and therapeutic vaccines. One of their main focuses is to develop next-generation drugs and to commercialize them. AnGes has already one product, which is in-licensed (developed by a firm in the U.S) and marketed by AnGes on the Japanese market and a couple of others in ongoing clinical development. It was in 2002 that the company got listed on the stock exchange in Tokyo. With its location in Osaka, AnGes is a part of the Osaka biomedical cluster. Their aim is to become a 'global leader in the field of gene medicine'.

6.2 Expected trends

Expected trends to be found in the data collected from annual company securities reports and on the corporate websites t are more thoroughly explained in chapter 5. I will use these expected trends as a guide when looking for data in the securities reports and other published reports from AnGes. The expected trends, summarized again, are as follow:

- the companies are innovative.
- the companies have positive growth.
- the companies were started by spin-offs, former university researchers or venture capitalists.
- the companies collaborate with universities or research institutes.
- the companies are located in close proximity to research institutes, universities and related businesses.
- the companies make use of the initiatives that the cluster (organization) provides, for example, activities, subsidies, tax reduction, location and so forth.

In the first point about innovation, the idea was look at how the company is trying to be innovative. There are several ways to find out if the company is considered innovative, for example they can be developing products that are new to the market or they can be investing in new gear that enhances their abilities to develop and produce such products. In the second point, I've been looking at the performance of the company to see if the company is growing. The focus of the third point is to look at the origins of the company, as this might give us indications to what kind of connections the company has. This may have an impact on whom AnGes choose to collaborate with. The fourth point states that companies collaborate with universities or research institutes. Collaboration with such an actor might give several benefits when working with research based products. The fifth point takes more of a physical approach; I've focused on registering how the company has positioned itself geographically compared to collaborating partners, whether it is universities or related businesses. It is also interesting to see if there is a pattern to which the company chooses to collaborate with. My last hypothesis states that participating companies in a cluster will make use of initiatives that may have positive economic benefits.

6.3 Results

This next section of this chapter will represent the results of my findings in the case study. The information in this chapter, unless otherwise noted, from the annual reports that AnGes submits to the authorities.

6.3.1 Innovation

One of the main drivers for a company to retain its competitiveness is to be innovative. I have therefore been looking for information within the annual securities reports that can give us the indications that the company in question is pursuing the goal of being innovative. I have also looked at what kind of measures the company is taking to be able to retain its competitiveness.

I want to start out by looking at what kind of business AnGes is a part of. The group is composed of the main company and several, very small subsidiaries. Their main business concerns research and development for pharmaceuticals and medical devices in the field of genetic medicines and therapeutic vaccines, but they are also engaged in products in the field of healthcare through their subsidiaries (AnGes Healthcare Science). Being engaged in gene therapy, which is a rather new type of field of research, gives the company many opportunities to be innovative through development and production of new types of products the market has not seen before. However, there are also risks involved with being at the forefront of such development. These risks are addressed in the annual securities reports in the section called *Jigyō-tō no risuku* (risk of the business). In each annual securities report, AnGes goes through the current state of the gene therapy industry as they see it, and they give an overview on how many of the vaccines and treatments are administered and what kinds of diseases the treatments may be able to treat. It is especially in one field that AnGes sees a business opportunity with one of their products aimed at ischemic patients (patients diagnosed with ischemia). Ischemia is when blood supply is restricted and there becomes a shortage of oxygen and glucose for the cellular metabolism. This again can then lead to blood clogging. AnGes is developing a product called HGF Plasmid that is aimed towards these diseases. HGF Plasmid is currently undergoing clinical trials; and is applied to three different types of diseases. According to the annual securities report from 2012, HGF Plasmid is considered by the company as a ‘revolutionary drug that regenerates new blood vessels in cases of ischemic patients’ (AnGes, 2012, p. 6). In the reports, they say that this type of disease is common and therefore it will gain more attention as people sees it as an important field of research. Targeting a disease with many potential patients may give, in terms of business, good returns from the product they are developing. However, this will only happen if the product will perform as expected. One of the risks of developing new products is that the product that you have spent a lot of time and money on will not perform as expected and there might come a new product that is superior to your own product. This will therefore have a serious impact on the performance of the company. AnGes states several times in the reports that gene medicine is a difficult technical field to work on research and development (AnGes, 2013, p.12; AnGes, 2014, p. 11; AnGes, 2015, p.11).

AnGes is also working on other projects, such as NFkB Oligonucleotide and a type of DNA vaccine. The NFkB Oligonucleotide is split into three projects, where the drug is used in three different areas. First of these projects is to use this drug against atopic dermatitis, a kind of inflammation of the skin, where the skin becomes, red, swollen and itchy. This kind of skin problem is often found among children. The second project involves the development of a medical device; NFkB Oligonucleotide is applied to a PTA balloon catheter that is used for restenosis prevention. In short, it is to help blood flow in the body. The last project where NFkB Oligonucleotide is involved is targeted towards disc degeneration. This project is in its preparation for second phase of clinical trials. Disc degeneration is often associated with lower back pains that are often developed when one grows older. In addition, AnGes also have several in-licensed projects. An in-licensed product is when a company gets the permission from another company to use their product, in the case of pharmaceuticals this is often intellectual property. This could be a product has come quite far in its development. A smaller company might out-license a product to a larger company if the smaller company don’t have enough resources to continue doing clinical trials. By using this approach, smaller companies can cut costs through collaborating with other actors in the same industry. One of these in-licensed products is called CIN (cervical intraepithelial neoplasia) therapeutic vaccine. AnGes has gained the licenses for development of the drug, and marketing rights in Japan, England, US and China from a company called BioLeaders, that is based in South Korea. This treatment is to prevent CIN to develop into cervical cancer for patients that have already been infected with human papilloma virus, more commonly known as HPV. Another in-licensed project is Allovectin. AnGes acquired their rights to development and marketing in Asia from Vical Inc. (US). Allovectin activates cellular immunity specific for tumour cells. AnGes' last in-licensed project is also acquired rights from Vical; and is an antibody therapy for Ebola.

To give an idea on how long the company expects to use on each project that they are developing, AnGes has made an overview of the process of their research and development. They expect to use 2-3 years on basic research. This is to create new substances and narrowing down candidate substances to continue working with. The next phase is called preclinical trial, and they expect to use 3-5 years. During this time, they test to confirm the efficacy and safety of the substances they found in the first period by testing them on laboratory animals. Next comes the clinical trials; and the trials are divided into three phases. In the first phase, they examine the safety and how the drug moves within the body. This is test on a very few number of healthy people. When the first phase is completed, they go over to the second phase of the clinical trials. The drug is now tested for its safety and efficacy on a small number of patients. The last phase of the clinical trials is targeted towards a large number of patients. They are then comparing the efficiency and safety with existing drugs. Overall, AnGes expects to spend 3-7 years on the clinical trials. We can see that AnGes expects to use the longest time on conducting clinical trials. If the clinical trials pass with successful results, the company may then send an application for registering the product. The last period will be waiting for the Ministry of Health, Labour and Welfare (MHLW) or Food and Drug Administration (FDA) in the U.S, to review and approve the application of the drug. This may take up to 2 years. During all this time, other products might have arrived on the market or patents that are superior to your research. This shows that developing and researching new types of medicines and treatments is an expensive and time-consuming affair. By adding up all the periods, we can see that AnGes expects to use, at a minimum, 9 years on research and development on a product before getting it commercialized. I assume that it will take 9 years if everything goes smoothly. However, if things do not go as planned and the company experiences a lot of delay; it may even take up, at most, to 17 years. AnGes has experience issues concerning clinical trials. According to Eyo (2015, p.39), Anges had problems “recruiting patients for clinical trials due to lack of incentives for both patients and physicians”. Another problem was the approval time for biotechnology drugs, mainly due to lack of qualified reviewers (Eyo, 2015, p. 39). In the report, AnGes mentions that there are no empirical rules or examples of previous research within this specific field of genetic medicines, and this may influence the development of products. To meet these challenges, it is also noted that since AnGes is a small company with limited resources, they seek collaboration with other pharmaceutical firms to reduce financial risks and maintain their innovative capabilities (AnGes, 2014, p. 12). I will be looking at how they collaborate with other actors later in this chapter.

However, AnGes utilises the drug development capabilities of other partners to become more innovative. Using partners to become more innovative and to reduce administration costs can be considered as an organisational innovation. By being innovative concerning the organisational structure, AnGes pursues to obtain personnel that is highly specialised in research and development. This is also a point in part of ‘issues to be addressed’ in the annual securities reports. AnGes notes that it is important for them to obtain highly specialised personnel and to educate their internal talents. If this somehow hindered, it may have an impact on the performance of the company. This shows that it is important for AnGes to get hold of right personnel to maintain their R&D capabilities. AnGes relies heavily on certain persons in the company, and they are looking to become less reliant on key personnel. However, it is stated in the reports that this will most likely not happen in the near future and they will continue being reliant these persons (AnGes, 2016, p. 22).

Most of the innovative capabilities that lie with AnGes are their focus on developing new products that the market has not seen before, or is an improvement to already working treatments. This is without a doubt an innovative firm when it comes to product innovations. However, the annual securities reports do not say much about other innovation types, such as process innovation. Process innovation is when a company invests money into new equipment or software that will enhance their ability to develop or produce products. It is mentioned every year that AnGes is mainly investing money in information technology such as IT equipment and equipment for development in their laboratory. However, it is interesting to look at how their investment in such equipment has developed in the last five years. The following graphs shows AnGes' expenditures on equipment and facilities from 2011 – 2015:

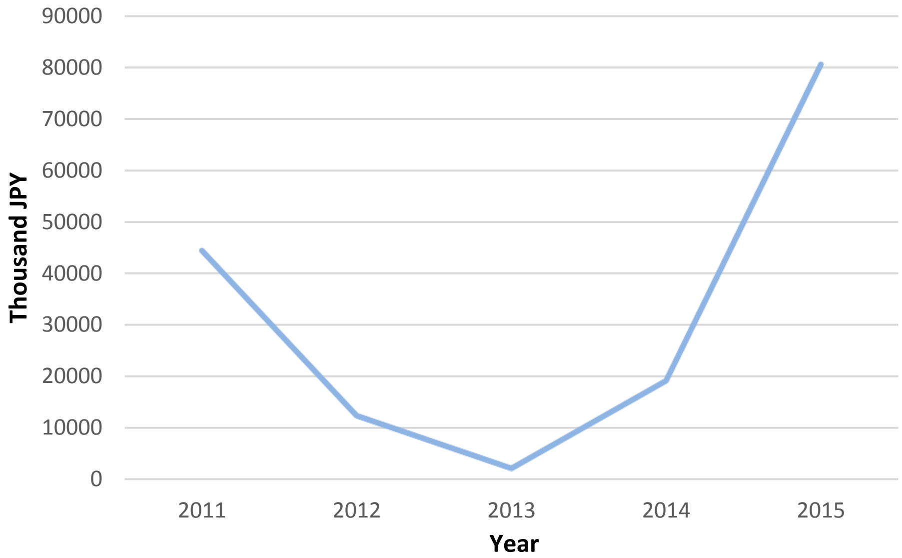


Figure 6.1: Investments in facilities and equipment over the course of 5 years. (Source AnGes: 2012, 2013, 2014, 2015, 2016)

As we can see from the graph above, it varies how much the company decides to spend on new equipment and upgrades to their facilities. AnGes has been investing money on mainly R&D related equipment for their laboratory and IT related equipment every year, except for in 2013. This is also shown in their expenditure in the graph, going down to 2.078.000 JPY. In the report for 2013, they mention that they have invested into a new rental warehouse (AnGes, 2014, p. 33). In 2015, it is noted that the investment on approx. 80.000.000 JPY includes tangible fixed assets, as well as intangible fixed assets (AnGes, 2016, p. 31).

6.3.2 Growth of the company

According to the definition stated earlier in this thesis AnGes can, based on information from annual security reports, be considered as an innovative company. They are clearly working on projects that might be an improvement to already existing drugs and treatments available on the market. However, even if the company is innovative, will this also manifest itself on their performance and the growth of the company? Arita et al. (2006) suggest that age and size determine the growth of a firm. According to his model, younger and smaller firms should more easily show higher growth rates, because of 'higher marginal labour productivity and technological innovation'. This could be true for most young and small companies if they are able to launch their products on the market. However, young and small companies, such as AnGes having less than 60 employees and started out in 1999, might not see the fruits of their labour until later because of the long time it may take to get a product out of its research and developing phase to actually hit the market.

An indication if a company is doing well may be to look at its labour force. A company might invest into new and specialised personnel to enhance their R&D capabilities. Therefore, I have compared the number of employees over the last 8 years and made a graph to see the development:

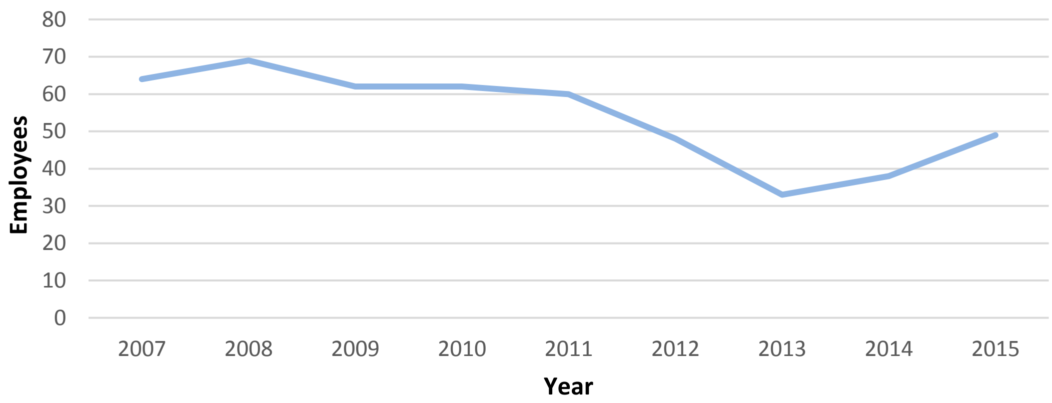


Figure 6.2: Number of employees from 2007-2015. (Source AnGes: 2012, 2013, 2014, 2015, 2016)

In contrast to many of the numbers that are submitted by AnGes in the securities reports, the number for employees go as far back as to 2007 in the report that was submitted in 2012. I have chosen to show these numbers to give us more insight to how the development has changed over the course of 8 years. We can see from the graph that there has been a steady decline in total employees from 2008 until 2013. It is noted in the securities reports that since the company is research and development oriented, AnGes considers therefore R&D as vital for their operation, and they will continually invest aggressively in R&D for the future. At the same time, they note that they will try to reduce financial risk through collaborating with other actors (AnGes, 2016, p. 28).

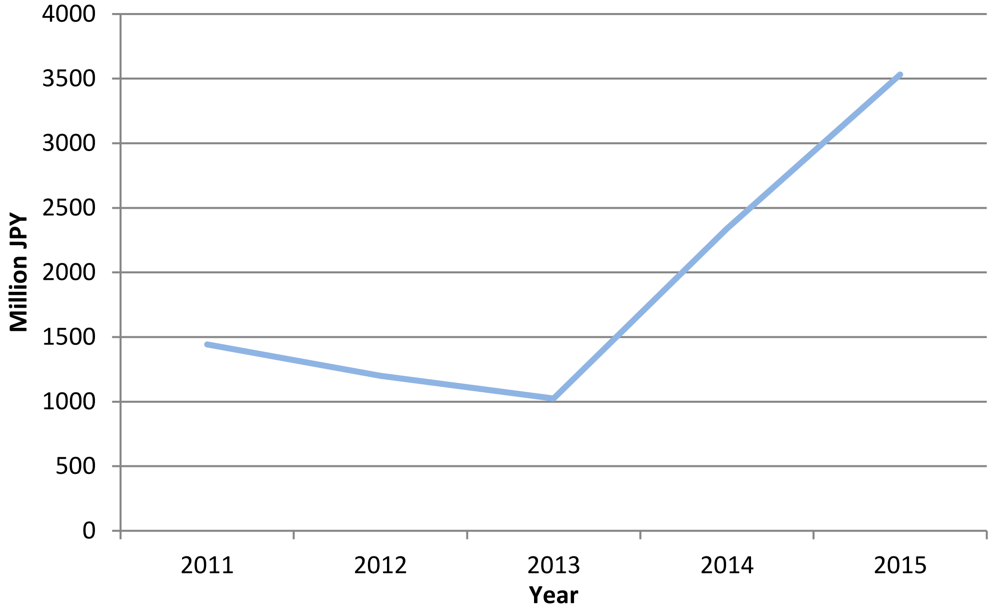


Figure 6.3: R&D expense for AnGes from 2011-2015. (Source AnGes: 2012, 2013, 2014, 2015, 2016)

If we compare the total numbers of employees (see figure 6.2) with their R&D expenses (see figure 6.3), we can see that the contours of the graphs are quite similar. However, the numbers for R&D expenses are more stable. The decrease in R&D expenses in 2012 is not mainly due to fewer personnel, but it is mentioned in the report from 2012 that the main decrease in R&D expenses is mainly due to decrease in patent royalty (AnGes, 2013, p. 33). In 2013, it is noted that one of the reasons for decrease in R&D is due to decrease in outsourcing expenses and decrease in total number of employees (AnGes, 2014, p.30). It is interesting to note that in R&D expenses took a drastically turn in 2014, mainly due to the cost of international joint phase 3 clinical trials for HGF gene therapy drugs. The high cost of clinical trials had also an impact on total number of personnel. However, it looks like there is an increase in both R&D expenses and personnel when HGF gene therapy drug started its international joint phase 3 clinical trials. Indeed, further increase in R&D expenses in 2015 is mainly due to international joint phase 3 clinical trials of HGF drugs, but also because of clinical trials phase 3 for NFkB related drugs. By looking at these two graphs (figure 6.2 and 6.3), we can see that the growth of the firm is closely related to what stages the development of different products influences both the number of the employees and how the company is investing in R&D. The numbers of employees have been kept low compared to the numbers that were submitted in 2007. I wrote earlier in chapter 3 on hypothesis, that growing firms may look for bigger facilities or offices if they are thinking of hiring more personnel. AnGes has not mentioned anything about expanding their offices to accommodate the new increase in personnel from 2013-2015.

Another indication that the company is growing is if their employees' average annual salaries are increasing. In order to evaluate the salary level in AnGes one can compare the average annual salary for employees of AnGes and compare them to other salaries in Japan. It is important to note that the way each of these salaries are calculate is different since they are from different bureaus, but it should give us an indication to how AnGes' salaries are compared to the average salary of a Japanese citizen and to other people working with scientific, professional and technical services. The numbers for average annual salary in Japan are collected from OECD[7] and the numbers for average annual salary for people working with scientific research, professional and technical services are collected from Statistical Bureau of Japan[8]. A growing company may be able to offer better wages for their employees. This can be a strategy to keep crucial personnel on the team. Offering higher salaries compared to the competition can help a company attract better or more researchers, which could again have an impact on the innovation of the company. A company's competitiveness is closely related to a former topic in this chapter, see the part on innovation. The Following graph (figure 6.4) shows the comparison of AnGes' salaries to other researchers and workers in Japan:

[7] https://stats.oecd.org

[8] http://www.stat.go.jp/english/data/nenkan/index.htm. The numbers are collected from Japan statistical yearbooks, 2011-2016.

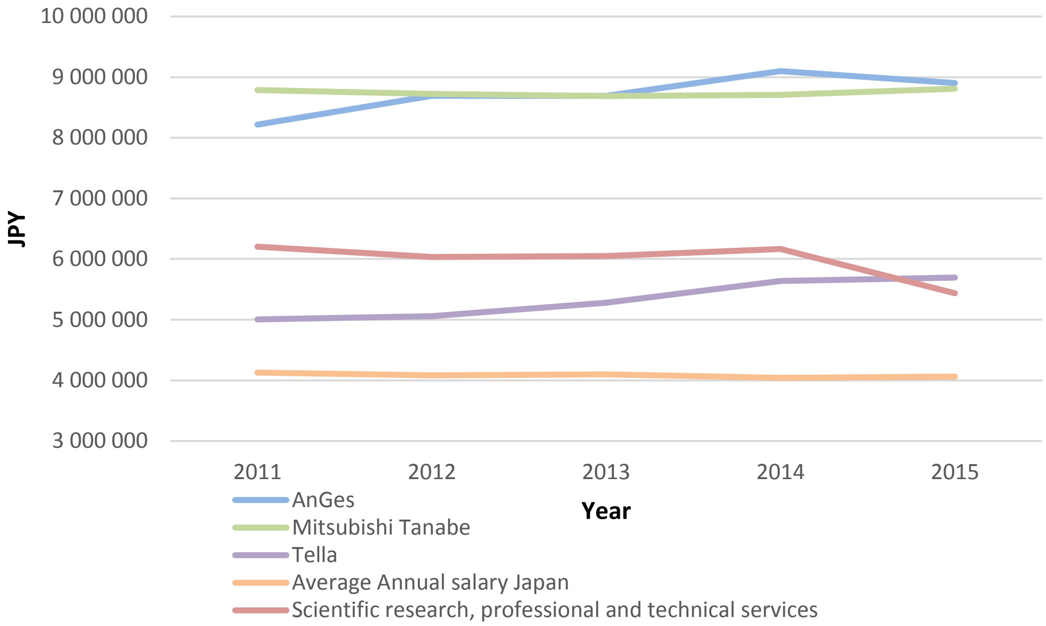


Figure 6.4: Average annual salary from 2011-2015. (Source AnGes: 2012, 2013, 2014, 2015, 2016. Mitsubishi Tanabe: 2012, 2013, 2014, 2015, 2016. Tella: 2012, 2013, 2014, 2015, 2016. OECD: 2015. Statistical Bureau of Japan: 2016)

AnGes does not totally consist of scientists and researchers, but this graph tells us that the average salaries in AnGes lie high above the rest of the country. We can then assume that AnGes will be able to pay for top personnel in order to remain competitive, with high R&D capabilities among their personnel. As a comparison, the average salaries of two other biomedical companies, namely Mitsubishi Tanabe Pharma Corporation and Tella Inc are included. Both of these companies are collaborating with AnGes in some way. Mitsubishi Tanabe is a major corporation located in Osaka and Tella is a small company located in Tokyo. We can see that AnGes' annual salaries can compete with both small and major companies within the same industry. As mentioned earlier, AnGes states in the reports that it is important for the company to able to secure talented personnel.

Last, the business revenue of AnGes will be considered. Business revenue may tell us on how the company is doing. Companies with high growth rate may show a positive increase in sales and other ways to receive funds.

As with employees (see figure 6.2), the four years prior to 2011 were included in the annual securities report for 2011. In the reports, AnGes differentiate between sales revenue and R&D business revenue; and the graph is made up by these two. R&D business revenues are made up by fixed rate of lump sum contracts, funds gotten from development cooperation; and royalties from affiliated companies. The numbers show that there is a constant decrease in business revenue since 2007 until 2011.

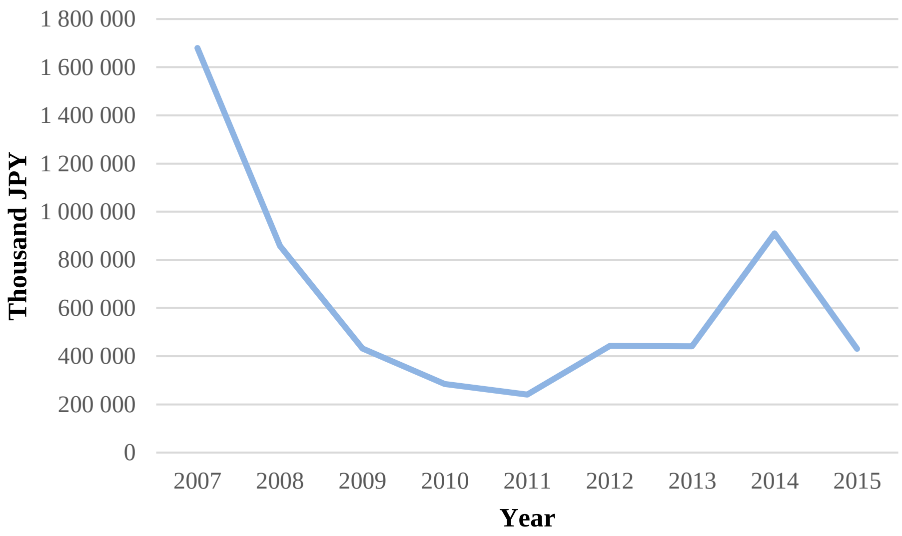


Figure 6.5: Business revenue from 2011-2015. (Source AnGes: 2012, 2013, 2014, 2015, 2016)

In the report from 2011, it is noted that AnGes includes development cooperation from HGF and NFkB as R&D business revenue (AnGes, 2012, p.13). AnGes receives fixed sums when certain projects hit different milestones. AnGes has only one product at the market, namely Naglazyme. AnGes also registers revenue from sales of research reagents to affiliated companies. In 2012, AnGes began selling a cosmetic product. There is a slight increase in revenue from 2012-2013, this is mainly due to milestone revenues from partner companies. However, in 2014, there was a major increase in business revenue. The company saw an increase of 418 million JPY, and increase of approximately 85%, to 909 million JPY. Yet again, this major increase in revenue is due to lump sum payment from partner companies. The major decrease in 2015 is mainly due to decrease in lump sum payment from partner companies. The business model for AnGes is to collaborate with other actors in the industry, in order to reduce risks. This is also shown in figure 6.4. It is noted in the securities reports that the company is still in the upfront investment stage, but they are making steadily advances on the research and development front, at time of writing, having two projects in phase 3 clinical trials.

6.3.3 Company origins and ties to related industry

One of the hypothesises mentions that we can find out what kind of linkages and circles the leaders of the company tread by looking at the origins of the company. Founders of a company will most likely retain their contacts in previous working environment, given that they have made friends among co-workers and other personnel. Keeping these kind of ties, may give the newly established company and entrepreneurs some kind of benefits from having contacts in relevant industry. Such benefits could include help to hire more relevant people for R&D department or it could give an advantage in market trends through closer contact with buyers. Instead of going to many conferences, researchers could pick up new ideas among fellow researchers at institutes and universities. This latter point is also mentioned in Powell et al. (2012, p. 459) that I reviewed in chapter 4. Public research organizations, such as universities, non-profit research centres and hospitals are considered to be ‘leaky’, because information easily enters and exits such organizations, which may seem to function as ‘high-speed gossip networks to carry stories of malfeasance’. I have chosen to look at current corporate management and origin of the company to see what kind of ties they might have to the pharmaceutical industry in Japan.

AnGes was, as mentioned earlier, founded in 1999, in the Osaka area. The reason for its creation was because it did not exist any companies at that time that were working with these kinds of treatments. HGF is one of most important projects that AnGes is currently developing and soon may be able to commercialize. HGF was discovered in 1980’s as a factor for increasing liver cells, and it was originally being studied as a drug for liver diseases. However, based on studies of HGF in 1995, done by Dr. Morishita Ryuichi, a professor at Osaka University Medical School, department of gene therapy; he found out that HGF could be used as a drug for regenerating new blood vessels for ischemic diseases. AnGes was later founded based on these discoveries; and Dr. Morishita Ryuichi was one its founders. He now holds the position as a medical advisor for AnGes. This goes to show that the company still has close ties to research done by researchers at Osaka University. It is also stated in the annual securities reports that the company will proactively introduce research results born at universities to promote the development of next generation biopharmaceuticals, mainly genetic medicine. Collaboration with universities is important for AnGes to stay 'at top of the game'. This may be a way for AnGes to gain access to new types of substances.

Lastly, I am going to look at the management of the company. AnGes has listed at their webpage who sits in corporate management:

Table 6.1: Management Team of AnGes (Source: https://www.anges-mg.com/en/company/comp_member.html. Accessed 25. March, 2017).

President and Chief Executive Officer	Ei Yamada
Member of the Board	Norikazu Eiki
Member of the Board	Ichiro Kitasato
Member of the Board	Junichi Komamura
Standing Corporate Auditor	Akihiro Narimatsu
Corporate Auditor	Shinji Toyama
Corporate Auditor	Tadashi Hishida

All of the people in the management team of AnGes have ties to major pharmaceutical corporations from Japan. Whether it is a branch of Mitsubishi Corporation, Bayer Yakuhin, Meiji Kaisha or Shionogi. It is interesting to note that 4 of these people have worked for Mitsubishi earlier in their career. AnGes have close dealings with Mitsubishi Tanabe, which is a subsidiary of Mitsubishi Chemical Holdings Corporation, and has made an alliance for marketing of HGF in Japan and the US. In 2012, AnGes entered in a collaboration with Mitsubishi Tanabe for marketing of HGF in the U.S. In the same year, Mr. Komura joins the AnGes as a member of the board. Mr. Komura has worked in the past for both Mitsubishi and Morishita Jintan. Other former employees of Mitsubishi, Mr. Hishida and Mr. Narimatsu, joined AnGes as auditors in 2002 and 2003 respectively. This may give us reasons to believe that these ties to Mitsubishi helps build the collaboration between the two companies. One person has ties to Shionogi. AnGes collaborates with Shionogi for marketing of drugs related to NFkB. However; it is only for Mitsubishi this kind of pattern applies to, where AnGes enters collaboration with another company at the same time as former employees of that company joins the board. Other interesting ties are to a non-profit organization (NPO) called Kinki Bio-industry Development Organization and Mie University. Kinki Bio-industry Development Organization works towards linking universities, research centres and industry and to foster university-industry-government collaboration. Mr. Toyama is currently holding a position of senior director at Kinki Bio-Industry Development Organization and Mr. Hishida is currently management professor for the medical/industrial linking office at Mie University. There are also ties to Kisato Institute in Tokyo and a company called Morishita Jintan, which AnGes had a joint research project with. This goes to show that former ties may influence the pattern to who companies decides to collaborate with.

6.3.4 Collaboration

In this part of the chapter I am going to take a look at how AnGes chooses to collaborate. We have already seen that AnGes has some collaboration with major pharmaceuticals and universities. To find a pattern to how AnGes collaborates with other actors, whether it be universities or firms in related industry, I have divided every year and taken note of when there is mentioned any kind of collaboration. It is not always easy to know if the collaboration goes over more than one year, as the annual securities reports will only report for the previous year. To accommodate this uncertainty, I have chosen to only register a collaboration if it is mentioned, and consider a collaboration for ‘ended’ if there is no mentioning of it in the next report. For example, AnGes collaborates with company B and this is mentioned in the report from 2012. In the next report, from 2013, this collaboration is no longer mentioned, and is therefore considered ‘ended’. There might be reasons for no longer mentioning the collaboration, as it may not have an impact on the performance of the company; and the collaboration may still be going on. The next graph shows the number of collaboration in mentioned in the annual securities reports and news releases from 2011 -2015:

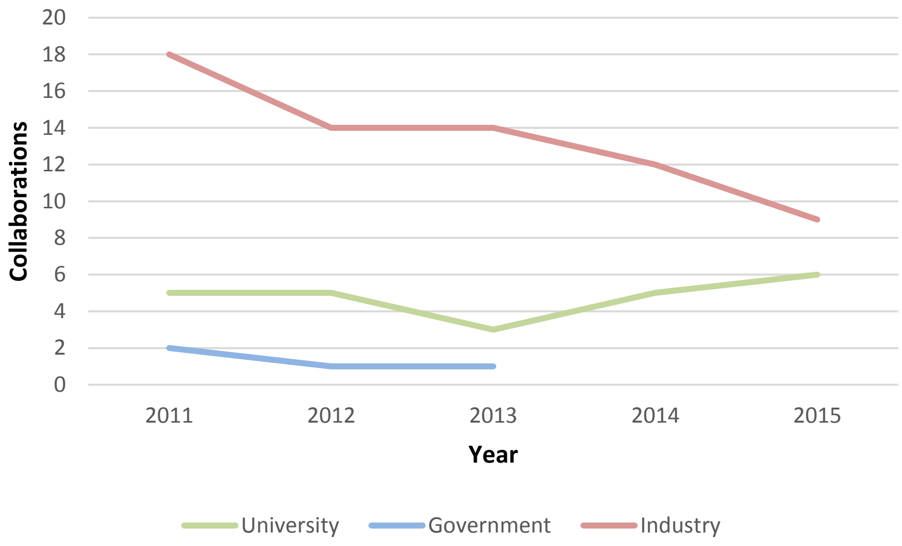


Figure 6.6: Collaborations from 2011-2015. (Source AnGes: 2012, 2013, 2014, 2015, 2016)

We can see that over the course of 5 years, AnGes has both sought collaboration with other actors in the industry and universities. This is stated many times in the annual securities reports that it's a part of the business strategy for the company to seek out partners in order to reduce R&D costs and to reduce risk in case of failed projects. It is also mentioned in the annual securities reports that AnGes will be based on research that comes out of the universities. This is not an unusual business model among small and medium sized companies. This is also one of the goals for the ICP, as mentioned in chapter 4. Small companies may not have enough resources to conduct all basic research themselves in order to find a drug candidate; and universities may have done research for promising products that they cannot commercialize. We can see a constant decline in total collaboration among industrial partners. This may indicate that there is no more room for investors at the current projects. As stated earlier, there may still be ongoing collaborating projects that are not mentioned in the annual securities reports. Another reason for fewer collaborating partner may be that smaller companies have been bought/merged by/with larger companies, or they may have fused with other smaller companies. As for 'government', this has been rather few. One project that AnGes partook was a joint research project started by METI. This project was a regional R&D innovation project for 5 academia- industry to develop a new drug for intractable inflammatory bowel disease. Among the participants were Hosokawa Micron, Morishita Jintan, Osaka University, Aichi University and AnGes. The collaboration with universities has been rather constant, with a slight increase from 2014. This is due to projects entering phase 3 of clinical trials. Collaborations with universities are mainly R&D based and sharing data when conducting clinical trials. This graph does not show if AnGes has multiple ongoing projects with the same actor.

In my analysis, I have also noted when AnGes chooses to collaborate with other actors. There are especially two instances AnGes seeks collaboration. The first instance it is marketing and the second instance is R&D. Most the collaborating companies in marketing are larger firms; and in R&D, the majority is small and medium-sized companies. One of the reasons for seeking collaboration in marketing is because of the limited size of management resources, AnGes chooses to actively seek partners who wants to gain sales rights for their products. As mentioned earlier in this chapter, AnGes seeks joint R&D to reduce costs and risks for developing new products. The hypothesis that states that 'companies in clusters will collaborate with universities' is also confirmed. The nature of the industry in which AnGes is a part of is dependent on R&D. Companies can also gain licences to scientific research done at universities, making it easier to promote collaboration with universities. This is also true in AnGes' case. Throughout the years that the annual securities cover, AnGes has collaborated with several different universities, both domestically and abroad. However, there is no certain pattern for which university they collaborate with. However, one could say that their 'main' university is Osaka University, located very close to their own offices and laboratory. Collaboration with universities is of great value for AnGes, as it is mentioned in the annual securities reports that they will seek research done at such institutes.

To give an idea on where the collaborating partners are located, I have made a map that shows where each company and university is located. These geographical points are based on addresses that each company has put up on their web sites, and considers as their location for their headquarters. Note that many of these companies have offices

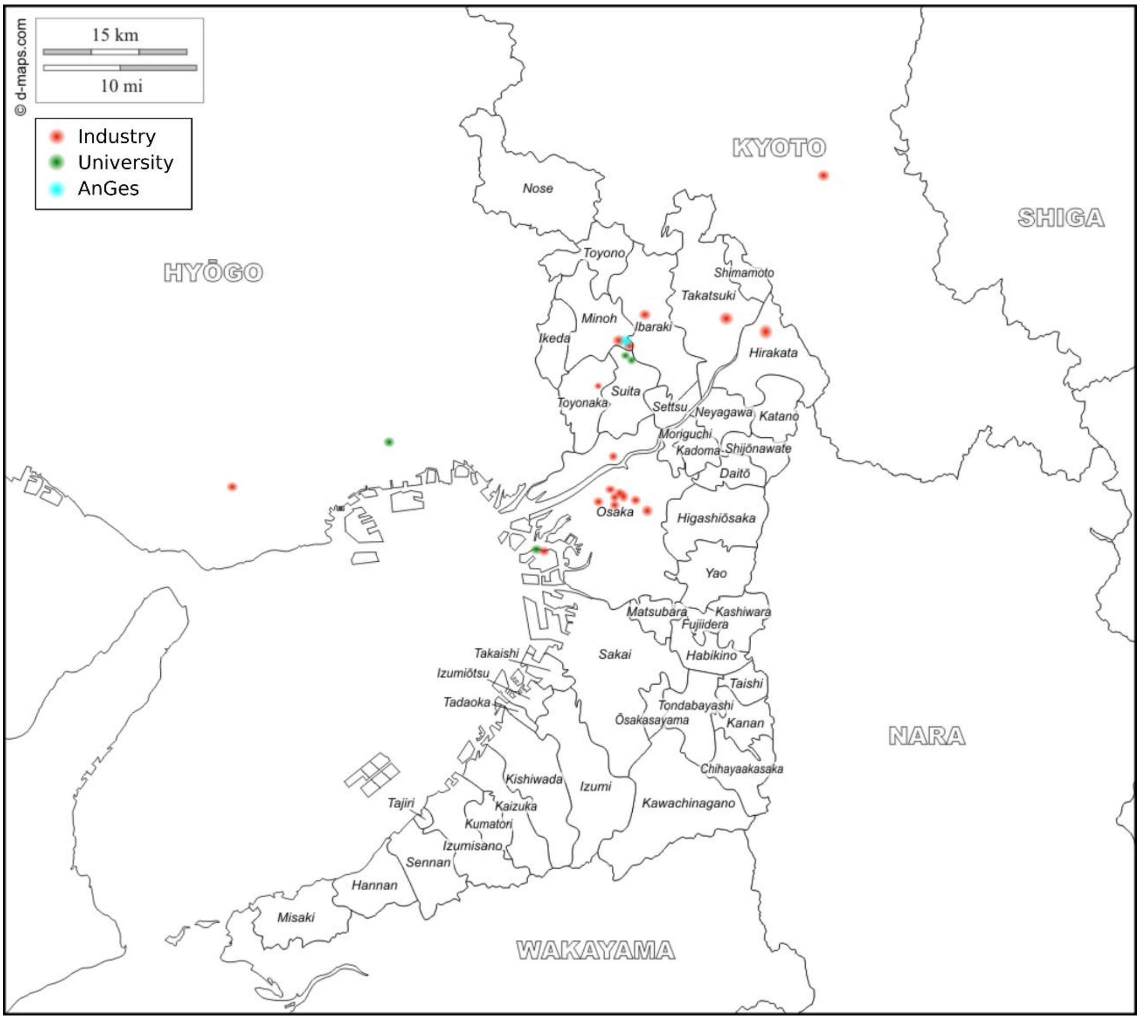


Figure 6.7: Location for collaborating partners from 2011-2015, Kansai.

in other cities, as well. For example, AnGes have their main offices in Osaka, but they do also have offices in Tokyo. I have made these maps using a combination of two free software[9]. I have chosen to have a focus on Osaka since this is where the concentration of collaborating partners is highest. These maps show the location for each collaborating

[9] The first program is called 'Gnuplot' and second one is called 'Inkscape'. Gnuplot was used to get each geographic node to represent its GPS coordinate. Inkscape was then used to make a more detailed and visually pleasant picture to study. All maps were download from d-maps (www.d-maps.com).

partner from 2011-2015. The first map (see Figure 6.7) is a zoomed in picture of the Kansai region, with Osaka at its centre. As we can see from the picture, AnGes' offices (represented as a teal node) are located in the northern part of Osaka prefecture, in Ibaraki, on the boarder to Suita.

Figure 6.8: Location for collaborations from 2011-2015, Japan

The two green nodes that represent universities, located just south for AnGes, is Osaka University and Osaka University Hospital. We can see that these two institutes are located very close to AnGes' offices and laboratory. Another interesting point to note from this picture (Figure 6.7), is the clustering of companies in central Osaka. This area is called Dosho-machi[10]. The green and red node just west for AnGes, represent a company and university located in Kobe. The next picture (Figure 6.8) illustrates every collaborating partner in Japan, Okinawa excluded. There are only two main bodies of concentrated locations of collaborating partners, namely Osaka and Tokyo. However, the pattern for universities shows something else. In Kansai, there are 4 different collaborating universities, but throughout rest of the country, there are 7 universities. The western most university is located in Saga (close to Nagasaki) and the northern most university is located in Asahikawa, Hokkaido. This pattern may indicate that companies may choose to collaborate with universities, regardless of their location. Whether the universities are located close to your offices or at the other side of the country. It is important to note, that in AnGes' case, collaboration with Osaka University is considered as one of their most important partners, as Dr. Ryuichi Morishita is one of their medical advisors. Lastly, AnGes gives out annually a reward they call 'AnGes Rewards' to important actors within the gene therapy community. This could be seen as AnGes trying to establish bonds with important people within this community.

6.3.5 Location

The next section and last part of this chapter is closely related to the former part of the chapter, namely location. This section will be based on the two hypothesises concerning 'the companies are located in close proximity to research institutes, universities and related businesses' and 'the companies make use of the initiatives that the cluster (organization) provides, for example, activities, subsidies, tax reduction, location and so forth'. These two hypothesises are closely related to the physical location of the company. As we saw from the previous part of the chapter, AnGes is located in the northern part of Osaka, not far from Osaka University[11] and other companies in related industry. Two of AnGes' collaborating partners are even located in the same building. The decision to be in close proximity to both related industry and university may be of practical reasons, with less traveling time and easier communication. AnGes has stated it

[10] See Chapter 5 for more information.

[11] Eyo (2015, p. 39) concludes that AnGes had strong ties to Osaka University through collaborations and joint patent filings.

is important for their business to acquire highly specialised personnel; and being located almost right next door to Osaka University gives them easy access to such. One can also assume some certain degree of spillover effect from being in same building as other companies in related industry, without spilling any graded company secrets.

While we're at the topic of being in same building as other related actors, AnGes rents its offices and laboratory at something called 'Saito Bio-Incubator'- building. The building is a part of an initiative promoting bio-ventures originating from universities. The building is privately administered, but is a part of a government (SME (small and medium enterprise) support, METI) and academia (mainly Osaka University, but also others). The administrators also have a policy to choose tenants that are bio ventures from universities, bio ventures companies based on research results of universities, bio ventures conducting joint research with universities or companies or conduct research with major pharmaceutical manufacturers and universities. The whole project is as mentioned, to promote bio-ventures and collaboration with universities. One of the benefits of renting offices and laboratory in this build is its costs. The graph below (Figure 6.9) shows the difference in costs for renting offices at the Saito Bio-Incubator and in Tokyo.

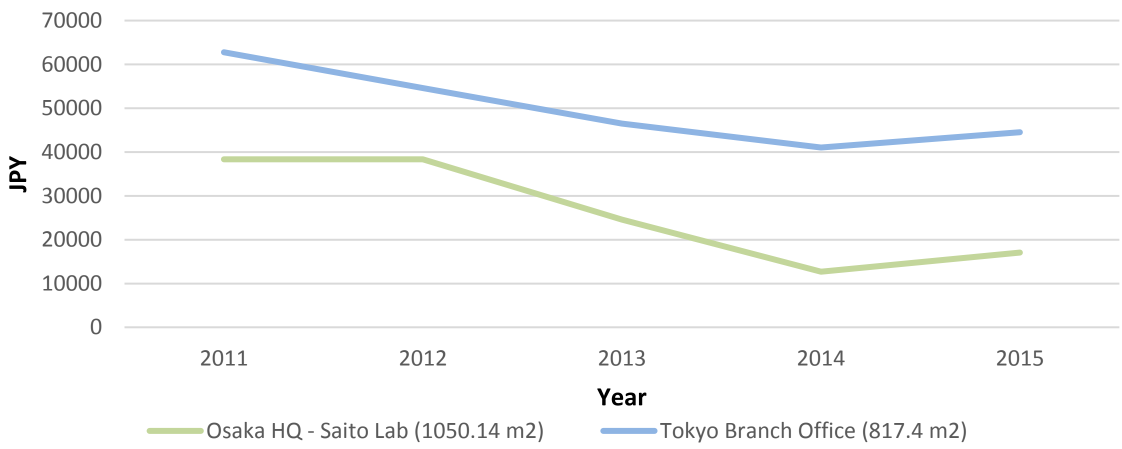


Figure 6.9: Annual renal fees in Osaka and Tokyo from 2011-2015. (Source AnGes: 2012, 2013, 2014, 2015, 2016)

There is a distinct difference in costs of these two places. Tokyo is known for its high rental costs, compared to Ibaraki in Osaka, but the price is almost half of what AnGes pays in Tokyo. In addition, The Headquarters in Osaka is over 200m^2 larger than that in Tokyo, and there is a laboratory. This goes to show that AnGes makes use of beneficial initiatives that comes with clustering. AnGes has also made use of other initiatives to gain subsidies. As mentioned earlier, AnGes had actively joined a joint research initiative started by METI. Through this initiative, AnGes received some subsidies for its research. Furthermore, one of AnGes' projects was selected for New Energy and Technology Development Organization's (NEDO) venture aid program. AnGes would then receive subsidies for its research, over the course of several years. AnGes also received an 'Intellectual property Award' for its research on HGF. This reward was sponsored by Osaka prefecture.

6.4 Summary

In this chapter, I have performed a case study on the company called AnGes. I have used the hypothesis from chapter 3 as a basis for gathering information in the annual securities reports and corporate website by AnGes. The findings show that AnGes is innovative in the sense that they are developing new types of drugs in a field of research that is rather new, however, they have yet to commercialise any products they have developed themselves. The findings also show that AnGes relies heavily on research that comes from universities and collaborations with different kinds of actors in the industry to receive funding for their projects. Collaboration is a major part of the business model of AnGes, it is also used as method to reduce R&D costs and risks in case of failed projects. The management of AnGes has ties to both collaborating partners and NPOs in the region. Through mapping all the collaboration in the past 5 years, there is a strong indication that AnGes chooses to collaborate with actors in proximity to their main offices and laboratory. AnGes also makes use of the benefits of being able to rent reasonable offices and laboratory. Lastly, AnGes has also been engaged in a joint research project started by METI.

7 Conclusion

The aim of this thesis was to study and describe a bio medical cluster in Osaka, Japan. To able to answer my research questions “How are clusters organized in Japan?”, and “How can clusters affect the development of a company?”, I chose to separate the findings of the thesis into three parts, each representing different levels. Namely national, regional and company level. This thesis sought to describe the bio medical cluster in Osaka by 1) providing renderings from policy documents released by METI and MEXT, and secondary resources by Arita et al. (2006) and Collins (2008), 2) detailed analysis of Osaka Bio headquarters, and 3) providing a delimited illustrative case study, on the company called AnGes. Based on the theories written about clusters, it was hypothesized that there are some trends among the participating companies in a knowledge cluster. This study has only used one company as its source for its company case study, however, I was able to use the easy, attainable data to confirm many of the hypotheses I have set as expected trends among companies that participate in a cluster.

7.1 National and regional level

This thesis has provided a description of the Japanese cluster policy through the analysis of the cluster initiative initiated by the Japanese Ministry of Economy, Trade and Industry (METI) in 2001 and Japanese Ministry of Education, Culture, Sports, Science and Technology’s (MEXT) basic plan for science, technology and innovation. This thesis has also used secondary sources to help describe other clusters, both within the same and different industries as the chosen bio medical cluster in Osaka.

The Industrial Cluster Project (ICP) was initiated with the goal to encourage more collaboration between the industry and academia. The initiative sought to provide an environment that would foster innovative solutions through research generated at universities. Especially knowledge based industries such as IT and biotechnology were targeted. Compared to previous attempted initiatives to increase regional innovative capabilities in Japan, METI took a more active role in the first stages of the initiative, and later they would let the clusters be more autonomous. This kind of approach is similar to that of successful clusters in Europe. The government’s role in the initiative was to help the actors in the cluster to find partners that might construct beneficial ties, with the emphasis that these ties should be horizontal. The government then took at matchmaking role in the initiative. We can see from the initiative and policies from MEXT that there is a political will to work for more innovation through clusters. When comparing the clusters described in the secondary literature from Arita et al. and Collins, we can see obvious traces of the polices from METI and MEXT. Through this analysis, we can see that clusters are organised as autonomous entities, with some interaction from the government. As the initiative has evolved since its beginning, there are now fewer clusters than at the start. This was also experienced at first hand when I was trying to find cluster candidates for to research on. Many of the old clusters mentioned in the reports from METI do still have 'ghost websites', but they are no longer in use, indicating no more activity. This may indicate that with less incentives from the government, clustering comes to a hold unless there are active key personnel as in the Kobe biomedical cluster. It would seem that key personnel are very important for the continuation of a cluster.

7.2 Company level

The case study performed in this work was based on findings in the annual securities reports and to see how the company has developed over the course of five years. This thesis used hypotheses that are based on the theories on clusters and innovation. The hypotheses are formed as expected trends for cluster participating firms. Such trends could be innovativeness, positive growth, collaboration with other actors in same industry, in proximity to actors in same industry etc. This thesis tries to answer whether or not these trends applies to the chosen firm in the analysis. The trends may indicate how the cluster has affected the development of the firm.

The company in question is without a doubt innovative. AnGes' main business concerns research and development for pharmaceuticals and medical devices in the field of genetic medicines and therapeutic vaccines. The gene therapy field is rather new, and this gives AnGes a possibility to come up with products that are not yet on the market. Because of the risks of the bio medical industry, long and costly research, AnGes seeks collaboration with different types of partners. Most of the innovative capabilities in AnGes lies in its focus on developing new products.

Whether or not the company is growing at the moment can be questioned. If we are looking at numbers concerning business revenue and total numbers of employees, we can say that AnGes has no growth at the moment. However, if we take a look at the R&D expenses, there is a substantial growth from 2013 to 2015. One of the reasons for having less personnel was to accommodate the expenses in clinical trials while investing in R&D. It is stated in the reports that it is seen as very important for the long-term goal of the firm to invest in R&D. As for the business revenue, it is expected to go up when their products can be commercialised. I have also looked at the average annual salaries of AnGes and compared them to other firms in the bio medical industry; scientific research, professional technical services; and average annual salaries in Japan. This shows at AnGes is very competitive when it comes to salaries. This gives AnGes the opportunity to get hold of specialised personnel and to compete with other large bio medical firms in acquiring this type of personnel. The management of AnGes has linkage to larger corporations and organisations within the cluster. Some of the ties are to collaborating partners. Whether or not these ties are the direct product of these linkages is hard to tell, would need further research.

A major part of the cluster theory emphasises the benefits of collaboration among actors in the cluster. In this sense, AnGes is very active and collaboration is a major part of the firm's business model. There are in especially two instances AnGes seeks collaboration, it is in marketing and R&D. Being a university spin-off, one of AnGes' most important partners is Osaka University. This is also mentioned in the theories that research based industries will have close ties to universities. To show how the geographic location of each collaborating partner over the last 5 years have been, I have made a map showing the location for the firms[12]. It clearly shows that AnGes has sought collaboration with companies in proximity to their own business. However, the pattern for universities shows something different. Collaborating universities are spread out over the country, from Kyushu in West to Hokkaido in the North. The pattern for collaborating companies may show that AnGes prefer to seek collaboration within the cluster. While on the topic of location, AnGes also utilises some of the benefits that comes with being in a cluster,

[12] See figure 6.7 and 6.8 in chapter 6 for more details.

such as renting offices and a lab close to Osaka University. This building has some criteria for its tenants; one is that they have to be collaborating with a University.

All the expected trends apply to AnGes. However, it is debatable if the firm is growing at the moment. As a conclusion, we can say that the cluster has affected the development of the firm in several different ways. In particular, the cluster has affected the firm by:

- Creating an environment where collaboration is beneficial.
- Majority of collaborating partners are in close proximity.
- The firm makes us of beneficial subsidies, such as reasonable priced offices and laboratory; and joint research projects initiated by the government.
- The firm has competitive salaries that may attract highly regarded personnel.

Collaboration can therefore be considered as a red thread going through a majority of the expected trends.

7.3 Further research

In my thesis, I have based the case study on one firm. It could be interesting to compare more firms in the industry, within the cluster and outside cluster. One such comparison could be to see if there are any differences in location for where the collaborating actors are located.

Another possible and interesting study could be to look at the end results of the ICP for when it officially ends in 2020. One could compare how many clusters there are in 2020 of the original clusters at the end of phase 2 of the initiative, and to see how many companies have been generated.

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