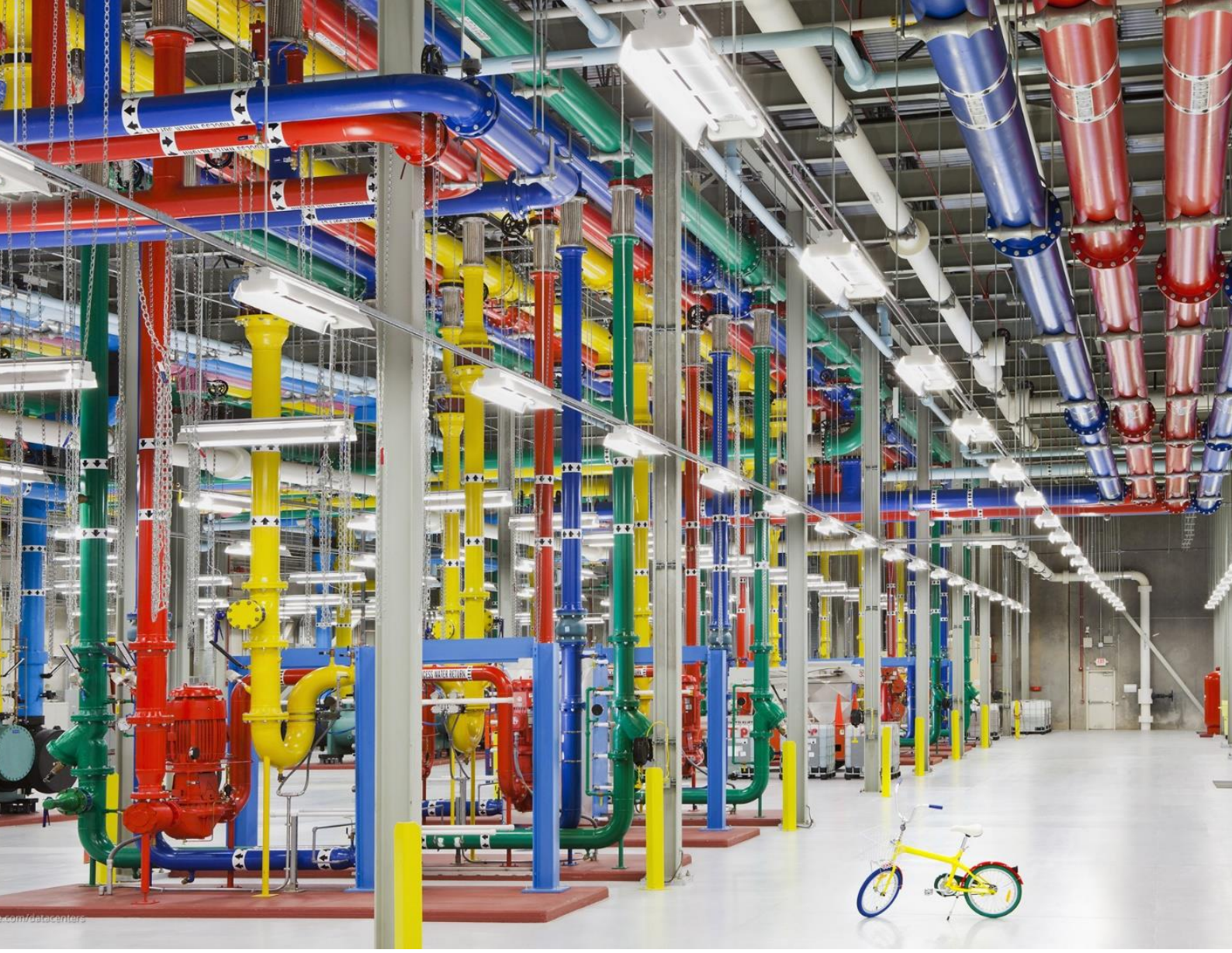

Creating an attractive cluster climate for datacenters in Eemshaven

The potential of Eemshaven as cluster area for datacenters compared with the successful example of The Node Pole

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Master thesis Economic Geography

Nijmegen School of Management, Radboud University

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Preface

Inhabitants of Groningen would say: ‘t Het mooi west. It has been nice. This research has investigated which actions stakeholders in Groningen should take, to create an attractive and sustainable cluster climate for datacenters. The match between regional offers and the needs of datacenters and IT companies is central in this research. This thesis is written on completion of my Master in Economic Geography at Radboud University.

Although writing my thesis has taken a lot longer than thought, I never lost my interest in the subject. That interest arose during different lectures in my master. Groningen was an unknown area for me, but that also attracted me. The demographic decline, quivering economic conditions and earthquake problems made me curious to the perspective of the regional economic development of Groningen. The announcement of one of the world’s strongest brands, to build a datacenter within this area, was extra intriguing to me.

This thesis is meant for stakeholders that are involved in the economic development of Groningen. I hope the research creates awareness for the potential Groningen has for datacenters and that it provides concrete actions for attracting and embedding data companies.

I would like to thank a number of people who helped me during this thesis. First of all, my thesis supervisor professor dr. A. Lagendijk which provided me with very helpful feedback during throughout the process. In addition, I would also like to thank all the respondents, both from Sweden and Groningen, for their time and cooperation in conducting the interviews. I also want to thank MBA K. Stob for giving me the opportunity of an internship at Public Result. Last but not least, I would like to thank my girlfriend Maaike for her support and encouragement that led me to the finish line.

I hope the research will be useful to you.

Adriaan van der Giessen

Stellendam, 27th July 2017

Inside a Google datacenter (Google, 2016)

Abstract

Many different institutions in Groningen perceive the arrival of Google's datacenter in Eemshaven in Groningen as a revival of regional economic development. Until the announcement, earthquakes, population decline and a stagnating economic development resulted in an unattractive image of Groningen. When Google communicated their establishment in Eemshaven, regional actors expected that other large datacenters would follow in the foreseeable future. Attracting and embedding these relative young and new establishments which are often transnational corporations (TNCs), requires other actions than embedding other businesses or SMEs.

This research investigates which actions local and regional actors should undertake to create an attractive climate for datacenters. In such a climate should the demands of datacenters match local or regional offers and vice versa. The basic idea behind this research is creating economic growth based on local or regional assets and opportunities. In order to gain insight into success factors, The Node Pole has been taken as an example. The arrival of Facebook in this area led to the rise of a strong datacenter cluster.

A combination of different theories led to a conceptual framework in which three key elements are distinguished that are of importance in embedding datacenter companies. The first element is about the impact of physical infrastructure to the embeddedness of datacenters in Groningen. Supply of energy, cable connections and the proximity of a city are part of the physical infrastructure. Intellectual infrastructure focusses on the connection between education and the labour market and its effect on the embeddedness. The third element is about the role of rules and regulations in embedding datacenters in Groningen.

To determine the extent in which these three key elements influence the embeddedness of datacenters in Groningen, eight propositions are designed. The propositions are confirmed or rejected by the outcome of interviews with stakeholders from Groningen and The Node Pole.

It is clear that the proximity of different power resources in Eemshaven is an important element in the embeddedness of Google. Through the various mix of resources, data companies can rely on different sources which creates a very high redundancy. The presence of transatlantic fiber connections in the Eemshaven is also an important element in the physical infrastructure. The embeddedness of datacenters requires an ongoing improvement of these fiber connections. Beside power and fiber connections, the proximity of a city with corresponding facilities and mobility modalities matters for attracting and embedding datacenters.

There is a strong dependency between physical and intellectual infrastructure. The Node Pole shows that a strong physical infrastructure is important for attracting new companies, while the long term establishment conditions are more dependent on a strong intellectual infrastructure. Developing knowledge transfers between Google and local knowledge institutions does not only generate innovation, it also fosters embeddedness. Beside these possible knowledge transfers Groningen has also many other valuable intellectual facilities that strengthen the cluster facilities, like a lectureship, an IT network and research centers.

Generally, public institutions in Groningen agree on the potential for a data cluster in Eemshaven. However, the fragmentation of different governments makes it less easy to stimulate the acquisition of new datacenters. Despite the fact that there is always room for improvements, current laws and regulations in Eemshaven provide enough opportunities to quickly establish new datacenters.

Inside a Google datacenter (Google, 2016)

Table of contents

Inside a Google datacenter (Google, 2016)

Introduction

The introduction outlines the context about the arrival of Googles datacentre in Groningen. After that, the research objective and question are given and explained. The third section of the introduction examines the relevance of the subject. The thesis outline is the fourth and last part of this chapter.

1.1 Context

The announcement of the establishment of the Google datacentre in the Eemshaven has been accompanied with a lot of attention and publicity. National newspapers and television stations reported on the large investment in the north of the Netherlands. The presence of the Minister of Economic Affairs had to underline the importance of the biggest investment in the Eemshaven in years.

From a geographical perspective, the investment of €600 million takes place in a special region. The Eemshaven is namely located in north east Groningen, a government-appointed area in which population decline occurs. Greying, de-greening and selective migration lead to serious consequences for the level of amenities, mobility, education, the housing market and the liveability of the region. The occurrence of population shrinkage is connected to mechanisms which have a self-reinforcing character. The principle of these mechanisms is, that population decline has a certain effect which reinforces the decline further. These effects occur in the field of employment, the level of amenities, housing prices and liveability (Leidelmeijer & Marlet, 2011). In this research, the mechanism of employment is an important element because of the economic attractiveness of the area. The population decline in northeast Groningen causes a decreasing labour population which results in a concentration of disadvantaged people on the labour market. Together with the greying labour population this leads to a unilateral offer of employment which is not interesting for companies. It is obvious that these developments are affecting the economic attractiveness of the region (Leidelmeijer & Marlet, 2011).

With these developments in mind the arrival of the datacentre seems to be an impressive economic boost for the region. But at the same time it is a challenge for the northeast of Groningen, with its shrinking population, to correspond to the regional needs of Google. In order to answer to the needs of Google, the region (especially the province and involved municipalities) has to know a lot of things. Why has Google chosen the Eemshaven, what elements are the cornerstones of a datacentre, in which areas do they need support in the preparation of the establishment and what elements do they need for a successful long-term strategy? The answer to these questions are of importance for the relations between Google and the region.

However, this chapter started with a somewhat negative perspective of the region (the ongoing population decline), the arrival of Google should be seen as a positive development. Groningen Seaports, the institute behind the Eemshaven, has a strong conviction that other datacentres will follow Google soon (Seaports, 2014). To show their amenities and locational benefits, Groningen Seaports presents it selves as Green Dataport, a place where datacentres should locate themselves. The arrival of the datacentre generates, according to Google, 150 jobs (Groningen Seaports, 2014). The amount of jobs is not limited to this number, because there are several opportunities in Groningen which can be utilized to make the area more attractive for other companies in the ICT sector. Upgrading the local resources, e.g. knowledge and skills, might generate extra activities and spin offs which could lead to a more attractive region for other datacentres, ICT related companies and entrepreneurs.

To seize the opportunities of Googles establishment, it is important that involved partners know and understand the difference between dealing with small medium enterprises (SMEs) and transnational corporations (TNCs) as Google is. In contrast to SMEs, TNCs are less fixed in specific areas because they act on a global scale. They are footloose which means that they are not bounded or tied up to an area in the same way as an SME is (Dicken, 2011). When conditions anywhere else better fits to needs and wishes of the TNC they may consider to move to other countries or regions. On the one hand these companies are attractive for municipalities or regions to persuade to move to their region because they often generate (indirect) employment. On the other hand, sudden changes in a TNC or region might cause a degree of uncertainty. For the involved partners in the Eemshaven this may lead to questions as: what can we do to keep Google in our region? Is it a matter of conducting the right policy? Or is it cooperating with different partners to bind Google more to the region? Do governments have to accept al wishes to maintain Google?

It could be very useful for Groningen to have an example which shows the possible regional effects of the arrival of a TNC. In Lulea the settlement of Facebooks datacentre led to the rise of a serious cluster of different datacentres and related suppliers. This cluster is called Node Pole. Node Pole has formed a cooperative network with public and private partners which promotes their excellent location conditions and tries to attract other datacentres to the area (Smolaks, 2015). The way in which the organisation takes place and the availability of facilities that are needed for datacentres caused the emergence of the cluster and a lot of successful spinoffs. Not only the industry of Lulea began to prosper, also the city centre grows every year with 600 new inhabitants (Nilsen T. , 2016). Creating a comparable cluster in Groningen could mean a turning tide for the shrink in the northeast of the province. The process Lulea has accomplished, is useful for Green Dataport, and after all for the regional shrink.

1.2 Scope

This research has a strict defined framework. The subject is limited to the embeddedness of Google, and other potential datacentres in the Eemshaven. Discussing the embeddedness will affects many different areas, e.g. energy supplies or internet infrastructure. This is a potential pitfall because zooming in on the different topics might lead to a lack of focus on the research objective. Therefore, the discussed topics are always related to the embeddedness of datacentres in the Eemshaven.

This research is about TNCs. But the companies of subject are a specific type of TNCs: datacentres. It must be clear that results and conclusions of this investigation are not simply applicable to other types of TNCs because the conditions of establishment do much differ among different types of TNCs.

1.3 Relevance

This subchapter discusses both societal and scientific relevance. The first show the societal contribution of this research, or in other words the contribution of this thesis for east Groningen. The latter discusses the contribution of this research to the scientific debate.

1.3.1 Societal relevance

As a result of demographic decline, northeast Groningen struggles with a lot of different problems that often reinforce each other. The consequences are spread over housing, welfare, education, health care, economy, labour market and mobility. On the background of this research the economic strength of the shrinking region plays an important role. The economy in the east of Groningen is relative weak with less employment, low level of education, high unemployment and occupational disability (CAB

Groningen; E&E advies, 2014). Especially in shrinking areas it is hard to break this deadlock of economic weakness.

This research investigates the way in which Google can be bounded to east Groningen and in which way the establishment can be utilized to create a possible cluster of datacentres. Normally it is not very effective to attract more employment or companies to a region where population decline occurs, but the case of Google in the Eemshaven provides a good perspective for east Groningen. Good physical conditions of establishment for datacentres and related businesses are important reasons to investigate the potential of a cluster of datacentres. The possible emergence of such a cluster should lead to significant more jobs in the northeast of Groningen. This can help the area to soften the population decline. The example of Lulea shows that the presence of a TNC may lead to the emergence of a whole new cluster which attracts a lot of new inhabitants, businesses and indirect employment.

Beside the above mentioned relevance this research delivers more insight into the manner in which Google acts in a region and how different governments or other actors, like Groningen Seaports, should anticipate to the policy of Google. In the east of Groningen are not many TNCs like Google located. This means that local governors are not really used to the way in which these companies are controlled. This is important, particularly because Groningen Seaports wants to attract other big datacentres. Here, also the example of Lulea helps to understand which strategy is successful to embed Google and attract new potential TNCs.

Also more specific insights concerning the role of different actors in the Eemshaven will be gained. It will become clear what the impact is of the datacentre for the energy suppliers in the Eemshaven and at a higher scale for Energy Valley[1]. The latter is a relevant actor because Google wants to function as much sustainable as possible. Furthermore, this research shows if the presence of a stable, high-end physical internet infrastructure is of importance for the embeddedness of datacentres and probably related companies in the ICT sector. This is important for the developing or maintaining the internet infrastructure in Groningen. This thesis shows also shows the relevance of knowledge alliances between education or knowledge-intensive companies and datacentres. When it appears this is of added value, involved partners are also responsible for the embeddedness of Google and other prospective datacentres. Lastly, this research reveals if there is a sufficient number of study programs to respond to the needs of Google and other datacentres.

1.3.2 Scientific relevance

In this research I want to apply different concepts and theories to the subject of investigation. There is relatively much theory available about the embeddedness of transnational corporations in regions or rural areas. Especially in the last decade, geographers, for example Yeung and Peck (2003), pay more attention to the embeddedness of TNCs in specific geographies. The importance of a strong local embeddedness of TNCs is emphasized by Yeung & Li (2000) stating that this creates spill over effects and brings a lot of other advantages for an area. Also other work on local embeddedness shows economic advantages for regions (Yin, 2009; Pike, Lagendijk & Vale, 2000; Yeung, 2009).

Furthermore, much research that has been done on embeddedness or footloose behaviour of TNCs is done in Asian economies. The settlement of the Google datacentre in Groningen differs a lot, because of the regional challenge in the field of population decline. These the combination of anchoring a TNC in an area with population decline is not known until so far.

[1] Energy Valley is a foundation which stimulates sustainable energy innovations to create new jobs and stimulate the regional economy.

A combination of concepts and theories of embeddedness, footloose behaviour, cathedrals in the desert and strategic coupling is as far as known, not used before. Research which most closely matches this thesis conducted by Yeung & Li (2000), MacKinnon (2009), Yang (2009) and Domanski (2004). Yeung & Li are focussing on local embeddedness of TNCs in China. They confirm "the important role of local TNC embeddedness in regional development" (2000, p. 633). But the cases Yeung & Li used, and this also applies to Yang, MacKinnon and Domanski, are about manufacturing industries. No coincidence, because thinking about TNCs and embeddedness means thinking about local relations. These relations are most visible in connections between local, services, supplier or factories and the establishment of the TNC. Not only the mentioned researchers used manufacturing industries as example, other researchers do also. This is also noticed by Dankbaar (2004).

As stated, in recent years there has been done more research to embedding or anchoring footloose TNCs or embedding "cathedrals in the desert". The current status of research to embeddedness is, among others, designed by Yeung & Li (2000) when they emphasize two factors in embeddedness: "the previous economic strength of local partners and the large domestic market" (p.624). They showed that local embeddedness of foreign investment enterprises, e.g. through participating in technology development in local structures, increases the interest of locals for their products (Yeung & Li, 2000). Brown concludes in his research on local embeddedness, clusters and supply chains that the car industry in Sweden does not generate the regional economic growth, which is often promised by policymakers (Brown, 2000).

Thus, research that has been done on embeddedness of TNCs is not focussing on the type of business that this investigation does. Beside knowledge and labour datacentres of TNCs do, not need many local partners. This type of business is much less dependent on regional actors, facilities or amenities than other TNC types. As far as known now, the establishment of a datacentre in a certain area is almost entirely based on the availability of stable green energy, durable options for cooling systems and closeness of transnational internet cables (Groningen Seaports, 2014). This means that this type of TNCs might operate relative footloose with less linkages to related industries than for example production facilities which are often used in case studies. This requires a different approach when thinking about local embeddedness of TNCs which is not known until so far.

This research combines the theory of embeddedness with the concept of cathedrals in the desert and uses the concept of strategic coupling and place firm relations to explain intertwined (inter)regional relations. By using these theories, this investigation aims to fill the research gap about the role of actors or amenities in embedding TNCs.

1.3 Research objective and question

In this part I will elaborate and discuss my research objective and the corresponding question.

The research objective is formulated as follows:

The aim of this research is to discover the role that different regional and local actors have by attracting and embedding TNC datacentres in order to create a sustainable cluster which stimulates the regional economy.

The question that corresponds to the research objective is:

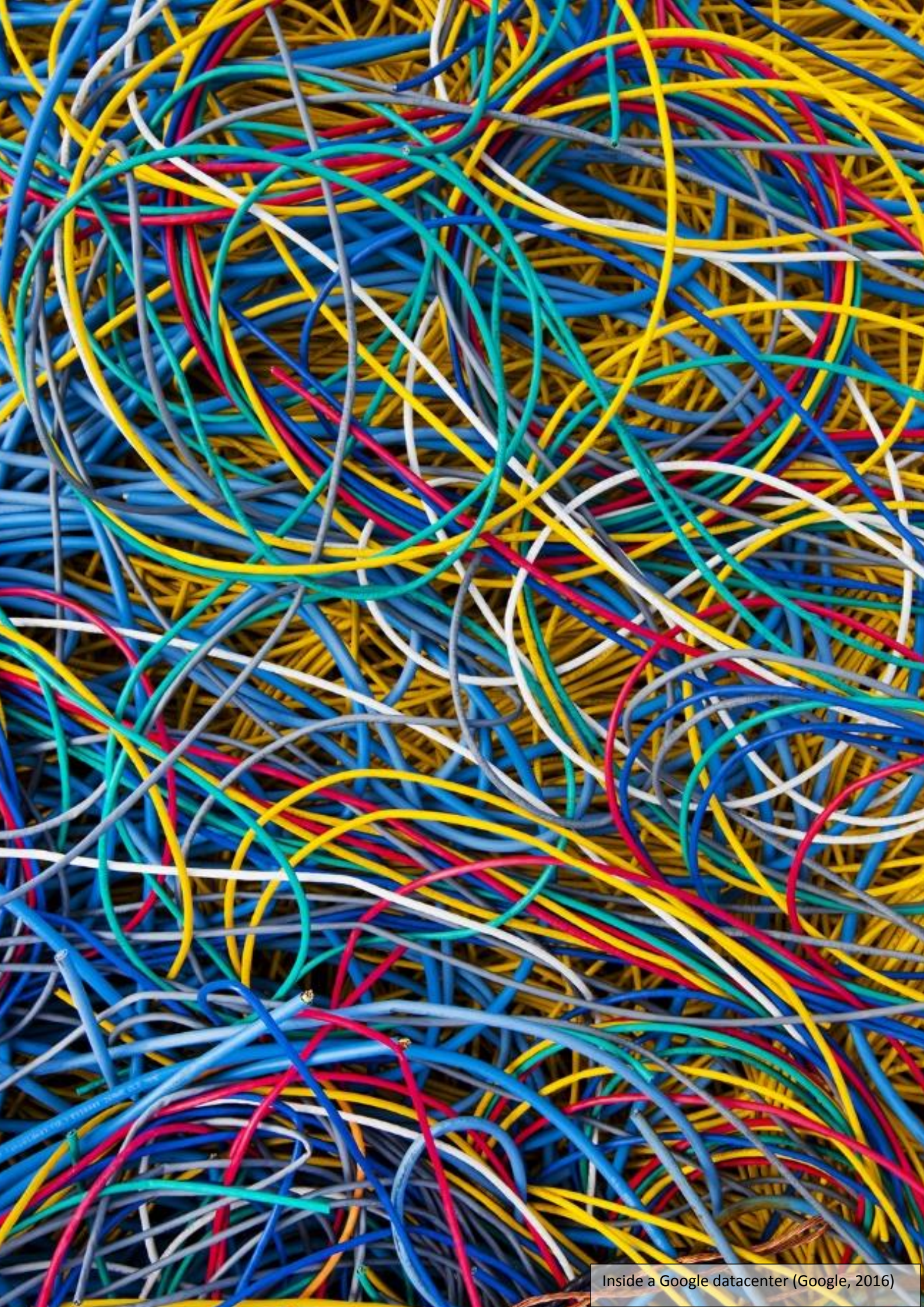
Which actions should local and regional actors in the Eemshaven undertake in order to create an attractive and sustainable climate for datacentres, in which local and regional offers come together with the needs of TNC datacentres?

Exploring the role and actions of different local and regional actors helps to understand the share the have in making Google or the potential cluster successful. This investigation will generate knowledge for actors like the municipality of Delfzijl, the province of Groningen and Groningen Seaports. The output of this research gives recommendations about spatial economic policy on different scales and provides a development direction for the Eemshaven and his actors for the next ten years in relation to the datacentres.

The rationale behind this research is creating economic growth based on local assets and opportunities. But, to reach growth there should be a clear and strong strategy in which lessons learned elsewhere are included. This is why the successful area of Lulea, The Node Pole, is used in this investigation. It should be realized that there are also other regions, for example in the USA, which profits of the establishment of datacentres in their surroundings but as far as I have seen are those regions less comparable with eastern Groningen than Lulea. The advantage of Lulea is that the socio-economic position before the arrival of Facebook is, in a certain way, comparable with the east of Groningen.

1.4 Thesis outline

The first chapter is an introduction to the topic and introduces the research topic and its scientific and societal relevance. Chapter 2 contains the theoretical framework which consists of different used theories. After discussing the different theories a conceptual framework is given, as well as eight propositions that are based on the conceptual framework. In chapter 3 the used methodology is central. This means the used research strategy is explained, delimitations are named, the way in which data is collected is justified and the process of analysing data is explained. This chapter finishes with the operationalisation of terms and expected outcome of the propositions. Chapter 4 provides background information of both regions in relation to the research topic. The results are given in chapter 5. Here, every proposition is discussed from a Eemshaven perspective and a perspective from The Node Pole. After the results, chapter 6 ends this document with conclusions and reflections.



Inside a Google datacenter (Google, 2016)

2. Theoretical framework

In this part I will elaborate and discuss the literature that I have read until now about “cathedrals in the desert”, local embeddedness of transnational corporations and the effects to their surroundings. I will also pay attention to the concept of strategic coupling and relations between and among places and firms as describes by Dicken (2011).

2.1 Cathedrals in the desert

An increasing interest for Foreign Direct Investments (FDI) emerged in the previous two decades in East and Central Europe. This process was perceived positive, because it would bring, direct and indirect, employment through local supply linkages, new knowledge by research and development transfers and more technical efficiency (Hardy, 1998). A positive view on these developments stated that this would attract other investors. The opposite thought that “regions or sub regions become sites for dispersed networks and are passively embedded in global networks” (Hardy, 1998 p. 640).

Grabher distinguished two types of investment strategies which can be related to FDI and regional development in East and Central Europe (Grabher, 1992). The first is “cathedrals in the desert” which is a form of investment based on cost savings. The lack of backward linkages hinders transfers from the enclave to the region. Short term contracts based on cutthroat prices, interferes the development of entrepreneurs, innovation and stabile SMEs (Grabher, 1992). These firms are isolated and exert hardly any influence or engagement to their surroundings (Hardy, 1998). The second type of investment strategy is “bridgehead”, and implies that “TNCs are interested in forward linkages and therefore pre-existing external relations are only partly paralysed as they try to maintain relationships with customers” (Hardy, p. 641, 1998). These strategy should offer more opportunities for entrepreneurship, innovation and a strong regional profit. Hardy concludes that the spill over effects from TNCs to the region were very disappointing and that “initial engagement to gain entry has been followed by disengagement with the local” (Hardy, p. 650, 1998).

Googles establishment is not based on a low cost argument but the concept of cathedrals in the desert is applicable to this case. The settlement of Googles datacenter is because of the proximity of a reliable energy supplier (the energy plant is located near Googles site), the availability of green energy, the entry of a transatlantic internet cable and a mild climate (Groningen Seaports, 2016). Google does not need cheap labour, suppliers, regional networks, business partners or other local resources. The datacenter could therefore stand on its own and become a “cathedral in the desert”. This is an undesirable potential situation in which only Google enjoys the benefits. For Groningen it is important that there is a certain interaction between regional actors and Google. In the next section I will focus on different relationships of TNCs and what these relations mean in terms of embeddedness.

2.2 Embeddedness

In literature, two different concepts are used namely embeddedness and embedding. First I will explain both terms in order to create more clarity. After that I will describe what it means in practice.

In embeddedness, two different subjects come together, namely “economic” and “social”. This is explained by Granovetter (1985) when he stated that economic action always is influenced by social

actions. Discussing embeddedness in this way means a fading of the difference between the "economic" and the "social" (Pike, Lagendijk, & Mário, 2000). The intention is to melt these two concepts together. In economic geography this means that "*social relations have a spatial structure"* (Pike et al., 2000), because they are much intertwined. Pike et al. uses the metaphor of "rootedness" to explain embeddedness.

Embedding is about the extent to which (socio)economic actions are connected or linked to parts that originally do not belong to the actors network (Pike et al., 2000). Applying the concept of embedding to geographical context, an area, region or country is the object which is embedded. The subject is for example a firm or industry within this region. According to Pike et al. (2000), embedding can also be explained by *""anchoring" or "tying" up the subject to the area."*

Now it is clear what both terms mean in theory we will focus more on the practice and what local areas can do to facilitate or furthering embeddedness. The importance of a strong local embeddedness of TNCs is emphasized by Yeung & Li (2000) stating that this creates spill over effects and brings a lot of other advantages for an area. Many different factors are influencing the extent in which a TNC is embedded in a local economy. Important factors are, as also mentioned above, the type of TNC affiliate concerned, the manner in which it is governed intern and the pursued policy by local governments. Strong local embeddedness can be also be created by a lot of interactions between institutions in a region (Yeung & Li, 2000).

Yeung & Li (2000) investigated important characteristics of local partners in relation to TNCs in Shanghai. They conclude that: *"strong local partners, together with other factors, have markedly affected the local embeddedness of EJVs (as part of TNC) as regards management, industrial linkage, and technology transfer"*. This shows us that it is important regions or areas facilitate partnerships in which local partners and TNCs meet each other and where new partnerships are formed. The type of business involved in these networks is very reliant on the form of the TNC affiliate. A R&D affiliate needs other partners than a production facility. Governments should act here as connector between educational and knowledge institutions, local businesses and TNCs. They should be responsible for bringing the right partners together to reach a sustainable and strong network. By leading and facilitating such a partnership, governments remain involved in the local economy and can recognize and respond quickly to problems or obstacles in practice. I will emphasize the importance of the leading role of the government because this accelerates the success. Especially because it takes time before foreign companies have bound themselves to local suppliers (Yeung & Li, 2000). This form of partnership is also known as triple helix.

Another finding of the study of Yeung & Li (2000) is that capturing the market by a TNC does not exclude a strong local embeddedness. By involving and working together with local partners, a TNC performs better because they use local knowledge about e.g. buying behaviour of consumers. But not only sales provides this benefit, also technology development for example *"the establishment of R&D facilities in local areas, makes products more sensitive to local preference"* (Yeung & Li, 2000). Foregoing results confirm the important role of local TNC embeddedness for areas. Besides the mentioned advantages the presence of a TNC delivers an area a stronger economic position and more jobs.

2.3 Strategic coupling

Strategic coupling is a concept which explains the relation between the demands of a TNC and the local assets a region possess. By describing demand and supply, of respectively, a TNC and a region, strategic coupling makes clear where white spots are located and what themes can be strengthened tie up a

TNC to the region. According to Yeung (2009) strategic coupling shows how important stakeholders in an area become expressed in the requirements of leading firms in a Global Production Network (Yeung, 2009). These firms can be seen as TNCs. Cox (1997) explained strategic coupling in Jacobs and Lagendijk (2014) as "the overall capacity accumulated within a specific local economy and a specific GPN to align interests and actives, with the aim of improving value creation and value capturing at the local and global level.

Strategic coupling can be seen as a mutual influence between a TNC and regional or local assets. For a region or a local government it is important to understand that the web, in which the TNC located in their region is involved, is a very complex field of different levels at the regional, national but also international level (Jacobs & Lagendijk, 2014). For Groningen this means, for example, that the local government has to communicate with regional government (province) but also national government to tune and adjust policy and possibilities to support or redirect Google in a certain direction. But not only government should be involved, also business associations, universities and labour unions should be involved in regional structures to tune wishes and needs in accordance with Google. It is important to check the type of affiliate and which facilities that specific affiliate needs. The datacenter e.g. needs green energy which means that also energy suppliers, or in this case Energy Valley, should be involved to create attractive deals.

MacKinnon (2012) describes a few other characteristics of strategic coupling. As first he emphasizes the "intentional actions and active deliberation by participants". It is not a noncommittal participation. Second MacKinnon explains strategic coupling is time and space contingent, different actors, which would not meet each other under normal conditions, work together in a partnership to achieve a shared goal. For Groningen this means e.g. a partnership between ICT companies for knowledge and labour supply, universities for research and government for facilitating structures and meetings.

The concept of strategic coupling works better when actors are capable to adjust themselves to the changing needs of a TNC. Flexibility and creativity are of great importance in this. In the case of Googles datacenter in the Eemshaven, for the region it could be very important to create and facilitate knowledge transfers to Google. For example the Rijksuniversiteit Groningen could play an important role in creating the knowledge transfers.

2.4 Place and firm relationships

While a more negative mind-set will focus on "cathedrals in the desert", Dicken (2011) highlights the relations a TNC has in their surroundings. Dicken appoints not only relations between TNCs and firms, but also places sees places as an important factor for economic development. The extent to which a TNC has a close relationship with the local economy is variable. But even independent affiliates, or "cathedrals in the desert", are not as independent as it seems (Dicken, 2011). They often have linkages in strategic alliances or take place in e.g. business networks.

According to Dicken (2011), there are four different relationship which shows the interconnectedness of TNCs. Firstly, intra-firm relationships: this is about connections between different parts of the same network. Each part tries to maintain its position. Inter-firm relationships, are relations between firms that belong to the separate networks with overlapping parts. Thirdly, firm-place relationships is about the firms capacities to maximize the benefits of the community in which they are involved, but also vice versa. Lastly, place-place relationships can be seen as a competition between places in which they attempt to capture investments of a TNC (Dicken, 2011).

The potential impact a TNC exerts on areas is spread over four different areas: capital injection, local firm stimulation, knowledge diffusion and employment creation (Dicken, 2011). The capital injection occurs for example by building a new factory for a TNC (Dicken, 2011). If, and to what extent, local firms are stimulated by the settlement of a TNC very depends on the type of the affiliate. Inter-firm linkages are important relations through which technological change happens. When a TNC orders specific products with stringent specifications at local suppliers, expertise will raise. This expertise can also be applied to other markets. To realize this and other spinoff effects, a TNC must choose to cooperate with local firms which. This choice is dependent on the strategy of a TNC. "TNCs that are strongly vertically integrated at a global scale are less likely to develop local supply linkages than firms with a lower degree of corporate integration" (Dicken, p. 436, 2011). The diffusion of knowledge occurs already by locating operations outside the home country of a TNC. But this does not guarantee that specific knowledge is accessible for a broad public in the host country (Dicken, 2011). "TNCs tend to transfer the results of innovation but not the innovative capabilities – the know-how rather than the know-why" (Dicken p. 439, 2011). Creating jobs, direct and indirect, are an important issue of the settlement of a TNC. The type of jobs is here again dependent on the type of affiliate but TNCs tend to concentrate production affiliates in developing countries, whilst higher qualified jobs are concentrated in developed countries (Dicken, 2011).

2.5 Localisation and urbanisation economies

The previous paragraph shows that the settlement of a TNC, or Google in this research, generates new local and regional linkages or activities. Usually, the establishment of a TNC does not go unnoticed by the government. They often see this as a way to accelerate their economic development. This is also visible in Groningen, after the announcement of Google many governors spoke about the great opportunities for the Eemshaven and Groningen as a whole (Baas, 2014; Eemsdelta EZ, 2013). But the type of economic development strategy to be adopted has, for a long time, two schools, localisation economies and urbanisation economies.

The concept of localisation economies is part of Marshall's philosophy on the economy (1890). In his work "Principles of Economics" Marshall remarks that industries in different geographic areas have different specialisms. By doing so, the specialized areas make use of proximity benefits, which means e.g. a reduction in transport costs between suppliers and users in the same industry or taking advantage of a well-trained labour market. "Localized external economies can be reduced to three basic sources: (i) thick markets for specialized inputs, such as skilled labour, intermediate goods suppliers and producer services; (ii) indivisible public goods, such as infrastructure; and (iii) knowledge spill overs, whether originating in the confluence of similar or diverse ideas" (Renski, 2011, p. 475). Later, additional work on localisation economies origins from Arrow (1692) and Romer (1986). Gleaser, Kallal, Scheinkman & Shleifer (1992) assembled the work of Marshall, Arrow and Romer into the MAR (Marshall, Arrow, Romer) model. The MAR model tries to confirm that specialization of an industry within a geographic area, fosters knowledge transfers between economic actors and promotes innovation for this type of business (Beaudry & Schiffauerova, 2008).

Urbanisation economies is the counterpart of localisation economies, because it states that diversification in regional economies is the most successful way to develop a sustainable strong economy. In this concept the interaction between different sectors is seen as a successful manner to foster innovation and create a stronger capacity for the establishment of different economic actors (Beaudry & Schiffauerova, 2008). In urbanisation economies it is about the availability of local assets, amenities and services. These are, for example, "infrastructure, access to local markets, urban amenities and other goods requiring a minimum level of human activity for efficient provision" (Renski,

2011, p. 481). Jacobs, seen as an important developer of the urbanisation economies, stated that "the greater the sheer number of and variety of division of labour, the greater the economy's inherent capacity for adding still more kinds of goods and services" (Jacobs, 1969, p. 59). Diversification, not specialisation, and variety of industries leads to new innovation and economic growth (Jacobs, 1969). Also Porter (1990) contributed to urbanisation economies when he stated that competition in local markets generates stronger growth. Janes and Porter both see competitiveness and its corresponding innovation as important for growth (Beaudry & Schiffauerova, 2008).

These two different views on the development of economies shows a fundamental debate about the direction of regional economic policy. However, the settlement of a datacenter is not new for Groningen, the establishment of the Google datacenter is of big importance for the development of the data sector (Groningen Seaports, 2016). This means that the province, municipalities and Groningen Seaports have the ability to choose a localisation or an urbanisation strategy for the economic development of the area. In the case of localisation, the authorities will have a strong focus towards attracting more datacenters and providing excellent conditions for the data industry. Urbanisation strategy would mean that authorities are pleased with the arrival of Google because it helps to strengthen the economic diversity and attractiveness in Groningen.

2.6 Linking the theories towards a conceptual framework

Foregoing theories will help to explore the extent in which Googles datacenter can be embedded in Groningen. Theory about "embedding" and "embeddedness" declare the phenomenon embeddedness, while the "place-firm relationships" from Dicken goes into specific elements behind the process. This helps to reveal forces, actors and relations in the process of embeddedness, it functions more or less as a way of looking at the whole process. Applying the place-firm relations to Groningen and Lulea will show important factors and elements that are, or will be, responsible for a well-embedded datacenter. "Cathedrals in the desert" will help to discover certain levels of embeddedness, which is important to indicate well-embeddedness. The concept of strategic coupling will show the extent in which Groningen has the power and opportunity to make themselves attractive for datacenters. The extent to which an area succeeds in the process of strategic coupling is partly dependent on the policy stance. When Groningen adopts a strategy corresponding with localising economies, the area might be successful in strategic coupling because they only have to focus on the data industry. Choosing for urbanisation economies would probably mean that Groningen is less successful in strategic coupling with datacenters because, in that case, they spread their economic policy over different sectors.

The embeddedness of datacenters is off course not dependent on one or two elements. Many different factors may influence the way in which a datacenter is embedded within an area. To keep an overview on all different elements, this research distinguishes three different bundles with factors which may influence the embeddedness. According to Anna Graf from The Node Pole organisation, power, space and latency are no longer the deciding elements to attract datacenters (Smolaks, 2015).

Different forms of infrastructure are essential for a well-embedded datacenter or datacenter cluster (Smolaks, 2015). Good physical infrastructure seems to be an *important* push factor for companies to establish their datacenter in a certain area. But intellectual infrastructure becomes more and more important once the datacenter is established. Especially when more datacenters descend in the direct surroundings of e.g. Google. Although physical and intellectual infrastructure seems to be important for the settlement and embeddedness of datacenters, rules and regulations are also crucial.

2.7 Conceptual framework

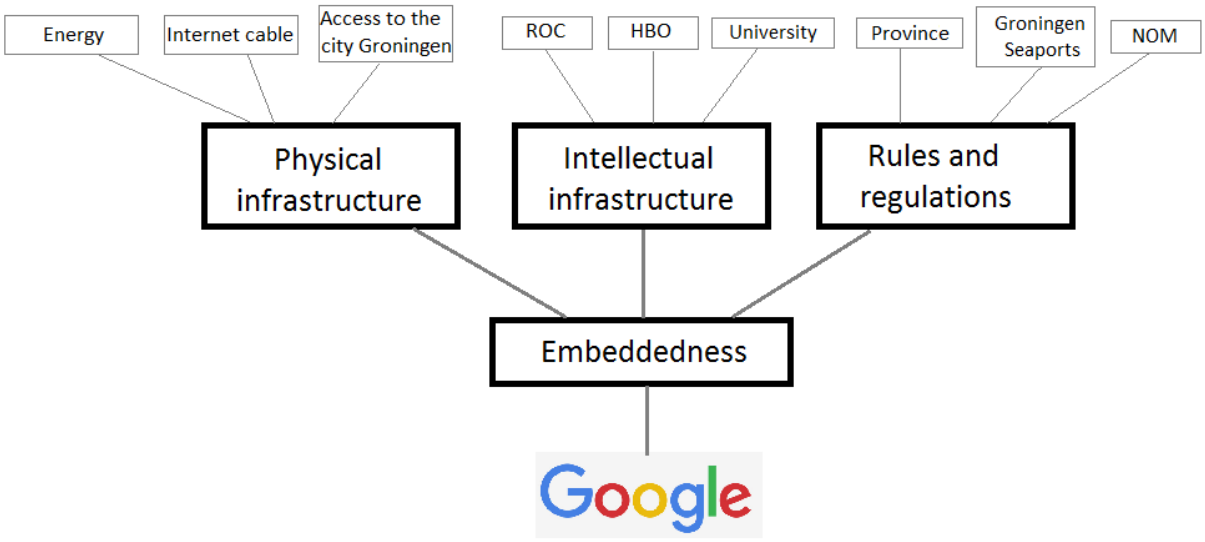


Figure 1.1 Conceptual framework

Figure 1.1 shows the conceptual framework. This framework will be operationalised step by step.

Physical infrastructure

Physical infrastructure determines not only the decision of establishment or not, but also, maybe even more important, the capability of adapting to new needs of companies. For example, sustainable energy is an important part of the sustainable strategy of TNCs. The Eemshaven should be capable to change their energy supplies from unrenewable to renewable power. The proximity of a transatlantic internet cable is also a facility that should be maintained. Also the quality of other internet related digital services is important, because a strong digital service sector needs a strong digital infrastructure. The access to the city of Groningen is an important part for international companies because of the facilities they need for their employees and guests e.g. housing, hotels and restaurants. Physical infrastructure in this research will not focus extensively on the most important perquisites which cause the arrival of the datacenter, but more on parts that should be maintained, strengthened or improved.

Intellectual infrastructure

A strong intellectual infrastructure is an important long-term requirement. Not only high educated people are important, even more important are employees with vocational education because they can apply the developed knowledge in the datacenters or deliver related services. The rise of a knowledge hub in which the three educational levels cooperate would be a very interesting cooperation to develop and apply knowledge. But also the proximity of an ICT knowledge campus could be an important actor. The presence of knowledge is important for Google which is shown by the organization of a digital workplace for employees and students in Groningen (RTV Noord, 2016).

Rules and regulations

The province of Groningen and Groningen Seaports are important actors when it comes to rules and regulations. For international companies and TNCs it should be clear who is in charge and who has the power to make decisions, because they encounter many problems in rules and regulations. The Northern Development Organisation (NOM) has also an important role in attracting and accompanying new companies. The way in which governments handle the contacts with and the needs of TNCs, which

have a totally different mind-set and view on e.g. hierarchy, can be decisive for TNCs establish or not. When they are established, a strong relationship between governments and TNCs is important. The way in which this should be done in an appropriate way is, in many cases, unclear.

These three elements can be seen as a way of strategic coupling which lead to a certain way of embeddedness of Google. The strength and durability of this embeddedness is dependent on the implementation of the different parts.

2.8 Propositions

In this research eight propositions are used to describe and explain choices, actions and phenomena in the establishment and embeddedness of Google. The propositions, which are based on the conceptual framework, will be investigated in this thesis. Each proposition is briefly explained. The propositions are connected to the central question which is also given before:

Which actions should local and regional actors in the Eemshaven undertake in order to create an attractive and sustainable cluster climate for datacenters, in which regional offers come together with the needs of TNC datacenters and advanced ICT companies?

1. *The proximity of (green) energy plants exerts direct influence on the embeddedness of (Googles) datacenters.*
   For datacenters electricity is what oxygen means for human. Datacenters therefore would benefit from the availability and proximity of energy plants in the Eemshaven. Also green energy is available.
2. *The proximity of transnational, overseas data cables are of interest for the embeddedness.*
   The landing of a data cable in the Eemshaven, originating from the United States, and the closeness to AMS-IX might have an important influence on the embeddedness of Google.
3. *The proximity of a city and, corresponding to that, good accessibility of the area has influence on the embeddedness of (Googles) datacenters.*
   A city contains lots of amenities which are useful for companies or employees. Good accessibility of the city and its surroundings facilitates the arrival of knowledge workers, partners, new entrepreneurs and delegations.
4. *For a well-embedded datacenter cluster, physical infrastructure is more important than intellectual infrastructure.*
   For the first years, physical infrastructure delivers Google more anchor points for embeddedness because intellectual infrastructure may not be important for a closed company like Google.
5. *The embeddedness of Google would not be enhanced by knowledge transfers between education institutions or knowledge-intensive companies and their datacenter.*
   It is possible that Google does not want to invest in knowledge relations. In addition, many higher jobs in the datacenter are probably fulfilled by foreign people. This could lead to a cathedral in the desert.
6. *The intellectual infrastructure of Groningen provides adequate facilities to answer the potential needs of a data cluster.*
   The range of courses at different educational levels, the Zernike campus and the ICT profile of the city Groningen are providing a good basis for an adequate facility range.
7. *Groningen recognises the importance of the embeddedness of Google and the construction of a data cluster.*
   The province, municipalities, Groningen Seaports and the NOM are important actors in the success or the failure of Googles embeddedness and the construction of a possible cluster. But the region is not very familiar to deal with companies of this type of industry.

8. *Rules and regulations are prohibitive for the embeddedness of (Googles) datacenters and a cluster.*
   A commonly heard remark is that rules and regulations constitute obstacles for the needs or wishes of companies. The arrival of Google also required the necessary changes in all kinds of plans. The question is, if there are still struggles which hinder the embeddedness.

The propositions are subdivided in three categories with the corresponding themes from the conceptual framework: physical infrastructure, intellectual infrastructure and rules and regulations. As can be seen in figure 1.2, the first three propositions belong to physical infrastructure. Proposition four, five and six are part of intellectual infrastructure. Rules and regulations consists of the last two propositions.

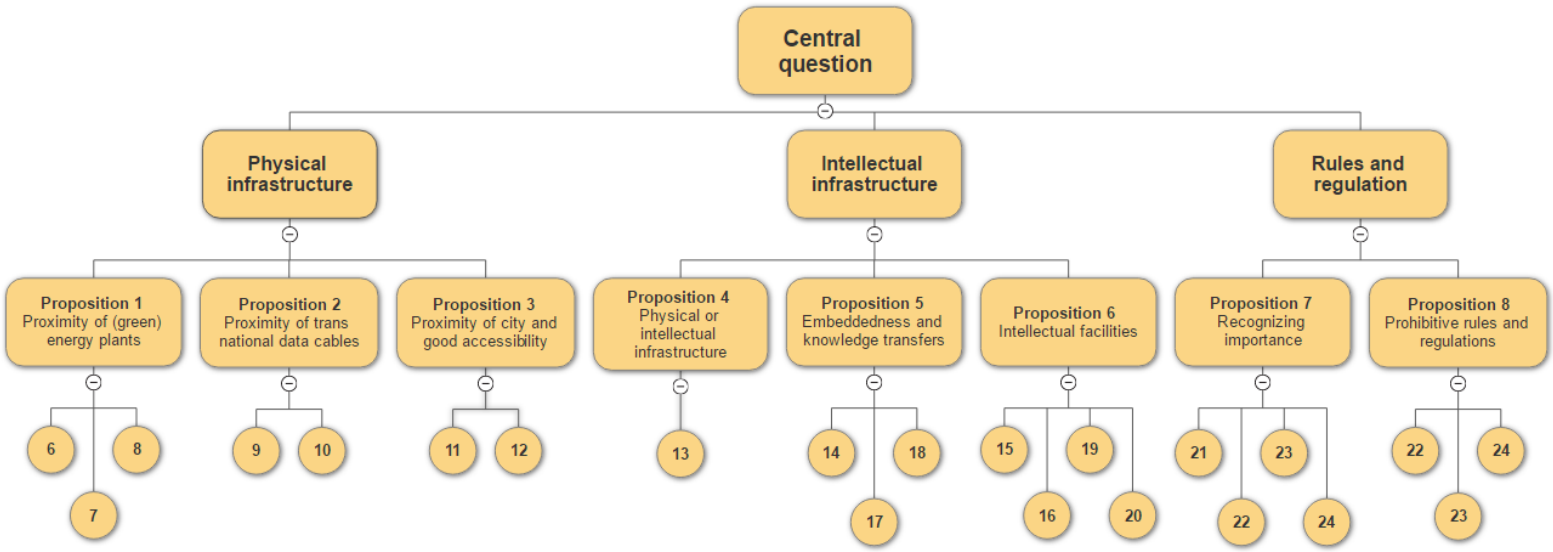


Figure 1.2 Research structure

Every proposition has its own interview question(s), which is visualised in the spheres containing numbers. The questions can be read in the interview guide**.** To perform the comparison between Eemshaven and The Node Pole as well as possible, the interview guide for The Node Pole is literally translated when possible.

Inside a Google datacenter (Google, 2016)

3. Methodology

This chapter discusses the research strategy and methodology. The first paragraph argues why the used strategy and method is chosen for this research. Paragraph 3.2 is about the delimitation of the research population. Paragraph 3.3 explains the way in which the data will be collected. The next paragraph shows the used method for processing and analysing the information.

3.1 Research method and –strategy

For this research a qualitative research method and strategy is chosen. The central objective and the question in this research ask for a profound approach because chapter 1 made clear there is not much research performed to embeddedness of TNCs, and especially datacenters, in western countries. This research combines the case of the Eemshaven with an example in Sweden namely The Node Pole. However the main focus will be on the Eemshaven, these are two different cases which should be compared and examined with each other.

3.1.1 Comparative case study

The method by which I will compare the two cases is a comparative case study. This means that I will work with qualitative research in order to gain the depth that is needed for this topic. The two cases, The Node Pole and the Eemshaven, show many similar characteristics, albeit that both areas are in a different stadium of development. This minimal variation is deliberately chosen because this is an explorative research. When there are large differences it is difficult to relate and compare the cases to each other. Furthermore, the embeddedness of datacenters relates to many different topics, which makes it a complex subject. As can be seen in the conceptual framework, this research focusses on three different aspect that have an important role in the settlement and embeddedness of datacenters.

Two different types of comparative case study design can be distinguished; the hierarchic method and the sequential method (Verschuren & Doorewaard, 2010). The hierarchic method first researches two (or more) cases separate from each other. The second step in this method concerns the comparison of the cases to find explanations about differences. The second method, sequential, would fit better to my research. In this approach, a researcher starts with an in-depth study to case A, then case B is researched compared with the results of case A. The first case will be the Eemshaven because this is the main topic of this thesis. It is important that I know the Eemshaven well, before I start investigating The Node Pole. This makes it easier to align the investigation at The Node Pole to concrete topics in Groningen.

The use of surveys in this research is less suitable because of the explorative character this investigation has. Surveys do not give the opportunity to focus on specific topics e.g. the core business of a respondent which are much related to the research question. Thereby, it is not easy to find enough respondents to gain significant data.

3.1.2 Interviews

To primary way to collect data in this comparative case study, is to conduct interviews on a semi-structured base. By using this method, it is possible to adjust an interview to specific topics broached by the interviewee. It is important to focus on these topics because this might be their specific field of involvement in the process of establishing Google, which brings new information. In-depth interviews helps, better than structured or closed interviews, to gain knowledge about different underlying

structures, causes or relations of subjects. Revealing these different structures, causes or relations is important because embeddedness is dependent on many different elements. This is also dependent on the knowledge of the particular respondent. Every respondent has its own field of involvement which means it is natural that not every respondent can answer all questions. In one interview, for example, the focus will be on the supply of energy whilst the other interview is focussing more on the process of dealing with rules and regulations. This justifies interviewing on a semi-structured base. This method is also suitable because the explanatory character of this research asks for a thorough technic in which it is possible to derive why things are organised in the way it is done or why some things are left.

Every aspect has its own weight of importance and nuances in the context of embeddedness. To measure the differences and take into account the nuances, in-depth interviews are a very useful instrument.

3.1.3 Desk research

Conducting interviews is not the only way to collect data, desk research is an important additional part to strengthen the quality of the thesis. In the desk research there is made use of policy- and vision documents, news articles, research about the used concepts and reports about datacenters. These documents are partly used to design the theoretical framework and had, eventually, influence on the interview guide. Because there is not much research about embeddedness of datacenters, there is made use of other research on embedding TNC"s in different contexts

Policy- and vision documents are used to explain the output of the interviews and to make clear in what context the developments should be seen. Especially the context of the Eemshaven and context about datacenters. Policy- and vision documents, especially from The Node Pole, Groningen Seaports, the NOM and the province of Groningen, sketch a framework in which the current status and future developments are explained. Also (regional) news articles were useful because this functions as a reflection of the perception of the region and its different actors. Al these different documents function as a solid fundament in the research. Together with interview data this functions as a stabile construction.

3.2 Delimitation research population

Central in this thesis is the arrival of the Google datacenter and potential other datacenters. Thus, the datacenters belong to the most important group of respondents. However, it is a given that this type of business do not want to share any information about their company. It is taken into account that it is possible the datacenters in Groningen do not want to contribute to this investigation. If this is the case than there are enough alternative sources available.

Many different actors were involved at the arrival of Google in Groningen. This is a benefit because there are a lot of different potential respondents available for the interview phase. But it is also a potential pitfall. Not every participant in the process of establishment is relevant for this research. Many different governments and semi-governments have been involved in the settlement of Google but some of them were only concerned because of specific issues as landscape integration. Therefore, respondents will be asked to cooperate in this research on the basis of an accurate selection. The key factor in this selection is the direct involvement of parties in the process of the establishment or direct links with the three distinguished fields, namely: physical infrastructure, intellectual infrastructure and rules and regulations.

In general, for Groningen it comes down to respondents of governmental organisations as the Province of Groningen, municipality Eemsmond, Groningen Seaports, Northern Development Organisation (NOM) and organisations in the field of energy, knowledge and education. This seems to be still broad, but investigating the embeddedness demands knowledge of direct involved or related themes. For the Lulea area, the type of respondents will be the same. In this case The Node Pole, a partnership between four municipalities to attract datacenters, seems to be most important respondent.

3.3 Collecting data

In any case, an in-depth desk research is important for both regions, this was the first step in discovering the regions. This meant a desk research on regional economic development, policy documents and regional spatial visions. After that I conducted interviews with important key figures in both areas, as stated above.

3.3.1 Finding respondents

Finding the right respondents was a challenging process. First attempts to gain access to the network of involved persons and organisations were stranded because the door was slammed. Especially organizations who work closely with Google were sometimes cautious and restrained in providing a contribution to interviews, because of a non-disclosure agreement with Google. Different attempts to make appointments with potential respondents turned out that it was important to emphasize this research not attempts to gain competitive information.

Through contacts at the province of Groningen a few names of persons were obtained, who have an important role in the process of establishing the Google datacenter or, at a higher level, realising Groningen Dataport. In contacts with these respondents I used the technique of snowball sampling (Bryman, 2001 p.18). This means I asked them for potential persons from their own network, which I could use for other interviews. This led to new respondents. In this way the most important actors, from different involved organisations and institutions in the network, were revealed.

Because I divided the interview structure in different parts, it was important to have enough variation in the respondents to cover each part. The method of snowball sampling was useful here because there are short communication lines in the region of Groningen. Many people know each other across different sector and organizations.

Planning the interviews took more time than expected before, because organizations first wanted to know more details and background of the research, and some respondents had a busy diary. It also happened that organizations referred several times to other colleagues in the organization. But overall, it should be said that people who were involved in planning and organizing the interviews were very helpful and friendly.

3.3.2 Interviews

For the interviews, an interview guide is formulated based on literature. The structure of the guide is derived from the conceptual framework which means there are four different parts. The guide functioned as a guideline during the interviews which means that every conversation was aligned to the knowledge and involvement of the respondent. Arguments for these semi-structured method are already given in paragraph 3.1.

The four parts of the interview are:

1. Introduction. A few general questions about the arrival of the Google datacenter and about their vision on the importance of the following three parts.

2. Physical infrastructure. This part focusses on the importance of the availability of energy suppliers, internet cables and proximity of the city Groningen.
3. Intellectual infrastructure. This part contains questions about possible interaction of datacenters with their surroundings with special attention to knowledge intensive industries and educational institutions. There is also attention for the situation at the labour market.
4. Rules and regulations. The last section goes into rules and regulations which could be prohibitive for the embeddedness of datacenters.

The total amount of interviewed persons about the Eemshaven is nine. After conducting these interviews there was a certain degree of saturation. This means, when the number of interviews increased, there was less new information about the three different topics in the interview guide. The duration of the interviews differed from 15 to 80 minutes. The interviews about Groningen are held in the Dutch language. Most of these conservations are held at the location of the concerned respondent. Doing research in the natural environment is part of this type of research (Verschuren & Doorewaard, 2010). Sometimes it was impossible to combine interviews on one day. Because of this it was inefficient to travel more than four hours for one interview. For this reason three interviews are held by telephone. All interviews are recorded.

3.3.3 Desk research

As stated above, beside the interviews there is made use of research, policy- and vision documents and news articles. Most of these documents are found by intensive browsing the internet. To have a complete overview on research that has been done on this topic, there is made use of the method of snowball sampling. This method is seen as an effective way to identify other related cases to increase the information density (Creswell, 2007, p. 127). Vision documents on regional economy and development were found on the websites of municipalities, province and GSP. Policy documents were sometimes mentioned in contact with stakeholders in Groningen or were named in other documents.

3.4 Data processing, analysis and elaboration

Analysing and elaborating qualitative information can be done in many different ways. The degree to which this is done systematically and the depth of the elaboration is may depend on the type of research (Flowerdew & Martin, 2005, p. 185). In a case study it is important to describe the situation accurately and precise (Creswell, 2007, p. 163). Creswell stated that: “the researcher seeks a collection of instances from the data, hoping that issue-relevant meanings will emerge” (2007, p.136). To find these “issue-relevant meanings”, the interviews are fully transcribed and coded.

The process of coding is aligned with the structure of the interviews. This means that the interviews are split and sorted to the three topics of the interview guide. To each topic belong a several propositions which are more or less recognizable in the interview guide. Answers of the respondents are sorted to the different propositions. After this step, the process continued by interpreting the different answers of the respondents per proposition. Most answers are complementary to each other which made it unnecessary to start open coding. Actually, the first step can be seen as a form of open coding, which combines answers about the same topic. To build and formulate answers that confirm or counter the propositions, techniques of the process of axial coding are used. This means that the given answers from different respondents are compared to make connections or distinguish meanings (Creswell, 2007, p.290). In this process, beliefs or perceptions between respondents are merged or distinguished per subject. By finishing this step, several building blocks are ready to build an answer to the proposition. These answers are formulated in the last step. By the use of arguments and the line of arguing as revealed in the previous steps, answers to the propositions are given.

The structure in which the results are presented follows the order of the given propositions. Every proposition is answered for the situation in Groningen and contains a paragraph with learned lessons from Lulea, which might be useful for the Eemshaven.

3.5 Operationalisation

The first part of this paragraph explains different terms in the central question. After that, the propositions are linked to the central question and will be operationalised. For each proposition an expectation about the type of answer is given, based on the literature.

3.5.1 Contextualizing the terms

Different terms in the central question need a further explanation and a frame in which they should be seen within this investigation. This helps to focus on the core of this research and shows the delimitations that some terms have in themselves.

"Actions"

The research question asks specific to actions which have embeddedness as final goal. But what does action actually mean in the context of embeddedness? As stated in chapter 2.2, embeddedness is about melting the concepts of the "economic" and the "social" (Pike, Lagendijk, & Mário, 2000). Embedding is explained by Pike et al. (2000) as *""anchoring" or "tying" up the subject to the area."* Within this context, actions should be seen as manners to "anchor" Google, as subject, to the Eemshaven. This research divides actions into three different categories, which are related to the "economic" and the "social". It is about physic actions, intellectual action and actions in the field of rules and regulations, the three fields which are central in this research. Physic actions are most related to the "economic", because it is about maintaining or improving the assets an area has. This is about the availability of green energy, space, redundant connections and so on. Social actions are close to the "social", here it comes to human connections, knowledge and availability. Examples of social actions are the launch of new studies for IT services, facilitating knowledge spill overs or cross overs between education and businesses. Actions in rules and regulations take place in the institutional scene, for example adjustments or concessions in zoning plans or requirements in the field of noise, environment or shape of the building.

"Local and regional actors"

This part of the question concerns the stakeholders in the area which are in for any reason involved in the arrival of Google or related to Google. It is possible they are directly related to the settlement of Google because they have legislative power, like municipality, province or the water board. However, not every direct related actor has legislative power, also other actors are of crucial importance, think of employees, energy suppliers, a water supply company and cable operators. But not every actor is direct related or of big importance to Google. A lot of them are only indirectly involved, e.g. catering industries, security, hotels, educational institutions, businesses networks, chamber of commerce and so on. These examples already contain different scale levels at which they act, namely, local and regional. Local is defined as the area within the boundaries of the municipality Eemsmond, in which the Eemshaven is located. Regional is defined as the province of Groningen. Both are of big importance because the local is not a stand-alone identity, it is also part of the region Groningen which functions together as a whole.

"Attractive and sustainable climate for datacenters"

Datacenters need different regional assets which are very important in the decision to establish a datacenter in a specific region. This is explained below. The challenge is to recognize and anticipate to these needs, in order to make the area more appealing. The image of the region to the outside must

contain the availability of the most important elements datacenters need. But propagating excellent business conditions for datacenters is only a way of communicating. In reality, datacenters should experience this attractiveness to confirm they made the right decision to establish in the most suitable area. This forms a basis for a sustainable climate. The word sustainable should be seen in the context of maintaining datacenters and IT related business, rather than the environmental context. Creating an attractive and sustainable climate are relative soft concepts to measure. But for this, The Node Pole is an important example from which lessons can be learned. In this research the elements for an attractive and sustainable climate are divided in the known structure of physical infrastructure, intellectual infrastructure and rules and regulations. Physical conditions can be of importance for companies to decide to open a new datacenter, for example the proximity to transatlantic internet cables. Intellectual conditions might ensure a sustainable long term relationship, e.g. through good connections between education and the IT labour market. Rules and regulations can constitute a decisive factor, in particular in the decision to settle or not. For example, the amount of corporate taxes and energy taxes seems to be important factor for being attractive or not.

"Regional offers" and "needs of (TNC) datacenters"

Actually, this investigation is about the convergence of local and regional offers on the one hand, and the needs of (TNC) datacenters on the other hand. This research aims to identify the necessary actions to bring both to the same level, with a strong embeddedness as outcome.

Regional offers includes the whole package of local and/or regional assets which may be of importance for the data industry. The boundaries for local and regional are still the same, the municipality of Eemsmond stands for local and the province of Groningen for regional. Currently, there are already important local or regional offers, which is confirmed by the arrival of Google. Groningen Seaports explains on their website Google was attracted to the Eemshaven because of the availability of space, energy, fiberglass and a suitable climate (Dataports, 2016). These parts belong more or less to the basic requirements for datacenters. But beside the basic requirements there is also a range of additional assets which could be very useful and pleasant for datacenters, especially in terms of embeddedness. Examples of additional assets are the availability of qualified employees, knowledge intensive IT-businesses, research and innovation institutions or the proximity of the city Groningen. It is in line with the expectations that the most basic requirements are situated in the first category, namely physic infrastructure. The intellectual infrastructure will probably contain more additional local or regional assets.

3.5.2 Expectations

This part discusses the propositions this research uses to answer the central question. Because the propositions are partly based on theory, a certain expectation about the outcome can be given already. In the chapter with the results the theory is substantiated by the outcome of the interviews. Nevertheless, it is possible the outcome of some propositions differs from the expectations. These unexpected findings are taken seriously because they may contain important elements for the outcome of this research. Now, the seven propositions are discussed:

1. *The proximity of (green) energy plants exerts direct influence on the embeddedness of Googles datacenter.*

   The use of electricity is inherent to the concept of datacenters. Within a datacenter the cooling system is the largest energy consumer. Energy usage has such high costs that datacenters use energy efficiency as way to compete (Rolvink, 2016). The transport of energy from power stations to users is inefficient because of transport losses. Therefore it is efficient for large energy consumers to establish in the direct surroundings of energy plants. Not only for this

reason but probably also for the security of supply. The presence of different power stations in the Eemshaven might be decisive for datacenters. The different possibilities for generating green energy in the area is presumably also decisive. TNCs often function as a role model in society, but at the same time they are also critically monitored. This might lead to an increasing importance of the availability of green energy. The expected answer of this proposition is that the proximity of (green) energy plants does affect the embeddedness of Googles datacenter.

2. *The proximity of transnational, overseas data cables are of interest for the embeddedness.*

   Overseas data cables are the highways of the internet. Actually they are the internet. They transport data, which is requested by users, via hubs to other continents or countries. For a datacenter from a company as Google it is, presumably, very important to have access to reliable and well-connected web of physic connections. Through this, they can guarantee fast response to requested data which is located within their datacenter. The expectation of the outcome of this proposition is that the proximity of transnational, overseas data cables are of interest for the embeddedness.

3. *The proximity of a city and, corresponding to that, good accessibility of the area has influence on the embeddedness of (Googles) datacenters.*

   As a result of the presence of a city in a certain area there will be a relative good infrastructure. Roads and railways ensure a good accessibility, hotels, restaurants, pubs, cultural amenities and apartments make sure that the city has attractive forces for a wide range. The city of Groningen has a lot of these amenities which are important for the citizens of the city, but also for inhabitants of the surrounding countryside. Eemshaven is located in an area in which population decline has serious effects to the availability of amenities. Because the Eemshaven is just half an hour from Groningen, it is expected that Groningen has a positive influence on the embeddedness of datacenters in the Eemshaven.

4. *For a well-embedded datacenter cluster, physical infrastructure is more important than intellectual infrastructure.*

   Physical infrastructure seems to be leading in investments decisions for establishing datacenters. But this proposition refers to a well-embedded cluster, something that goes beyond considered decisions about establishing in a certain area. It might be clear that a strong physical infrastructure is of big importance for datacenters but the question is if this infrastructure maintains its important position for the long-term. It is to imagine that, over time, intellectual infrastructure became more and more important because of e.g. knowledge spill overs and availability of appropriate labour. It is expected that, in contrast to the proposition, over time intellectual infrastructure is more important than physical infrastructure for a well-embedded cluster.

5. *The embeddedness of Google would not be enhanced by knowledge transfers between education institutions or knowledge-intensive companies and their datacenter.*

   It is not easy to predict the outcome of this proposition because Google has an extremely closed (communication) strategy. On the basis of the place firm relationships (see paragraph 2.4) is to expect that Google will have contacts with other actors in Groningen but the extent in which this will happen is dependent on the level of integration. Dicken (2011) stated that firms which are strong vertical integrated at a global scale are less willing to develop local linkages. This would mean that Google, as a relative vertical integrated global player, is not

very sensitive to e.g. knowledge transfers. On the other side, Google needs knowledge transfers or at least connections with education institutions and companies to maximize the benefits of the region. And Google emphasizes that they are open to community projects and are willing to provide community grants (Google, 2016). The expected outcome is that this proposition is false.

6. *The intellectual infrastructure of Groningen provides adequate facilities to answer the potential needs of a data cluster.*

   Alfa College, Noorderpoort, HanzeHogeschool and Rijksuniversiteit Groningen are important education facilities for the intellectual infrastructure. Also the IT sector in Groningen contains many companies that have an important role in the forefront of the sector, for example IBM and KPN Research. It is to expect that this proposition can be proved.

7. *Groningen recognises the importance of the embeddedness of Google and the construction of a data cluster.*

   The presence of Google in the Eemshaven is important evidence for the data industry, by showing that this place is apparently very suitable for datacenters. This might have interesting effects on the location choices of other IT giants. The question is if the area of Groningen, with its different key institutions, is aware of the opportunities of these developments within their borders. Only considering the amount of publicity around the arrival of Google, it can be concluded that the region is pleased to welcome Google (Nu.nl, 2014; Dagblad van het Noorden, 2014). The importance and opportunities for the future about the Google establishment for the area are often depicted in these news articles. The expected answer for this proposition is Groningen does recognise the importance of the embeddedness of Google and the construction of a data cluster.

8. *Rules and regulations are prohibitive for the embeddedness of Googles datacenters and a cluster.*

   Thomas Alva Edison once said, “there are no rules here, we’re trying to accomplish something” (Thomas A. Edison Innovation Foundation, 2016). The first part is of course not the case in Groningen, but the latter is surely true. To accomplish that “something” everyone has to follow rules and regulations. The first impression is that the establishment of Google caused a few issues in the field of spatial integration, process management among different authorities and a few other obstacles. Of course this further investigated in this thesis. It is to expect that rules and regulations are currently improved and therefore this proposition is correct.

Figure 4.1 The location of the Eemshaven (Google, 2016)

4. Facts and figures

This chapter focusses on the current situation in the regions of the cases, Eemshaven and the Node. Pole with respect to important elements of this research. Chapter 4.1 is about facts and figures of the Eemshaven. 4.2 discusses The Node Pole and follows the same structure as 4.1. The last subchapter compares both areas with each other.

4.1 Eemshaven

The first part, is about the Eemshaven and elucidates the location of the port with some numbers and maps. The next paragraph goes into the organisation of the Eemshaven and important stakeholders for further development of the port. Paragraph 4.1.3 focuses on different existent types of business in the Eemshaven. The last part discusses the future perspective of the Eemshaven.

4.1.1 Location

Eemshaven is located in the very north of the Netherlands, in the province Groningen. Figure 4.1 shows the location at an international perspective. The port belongs to the territory of municipality Eemsmond and is an important logistic hub for the shipping industry in northwest Europe (Groningen Seaports, 2009). The municipality of Eemsmond counts 31 villages and hamlets with a total amount of inhabitants of 15.700 (Wikipedia, 2016). The nearest city of importance is Groningen, which is shown on figure 4.2. Groningen is a growing city which counts 200,459 inhabitants in 2015 (Gemeente Groningen, 2016). Due to the large population of 50,000 students the average age of inhabitants is with 36.4 years low in comparison with other cities (Er gaat niets boven Groningen, 2016). Groningen has a university, Rijksuniversiteit Groningen, and a university of applied sciences which in the Netherlands is known as HBO, HanzeHogeschool.

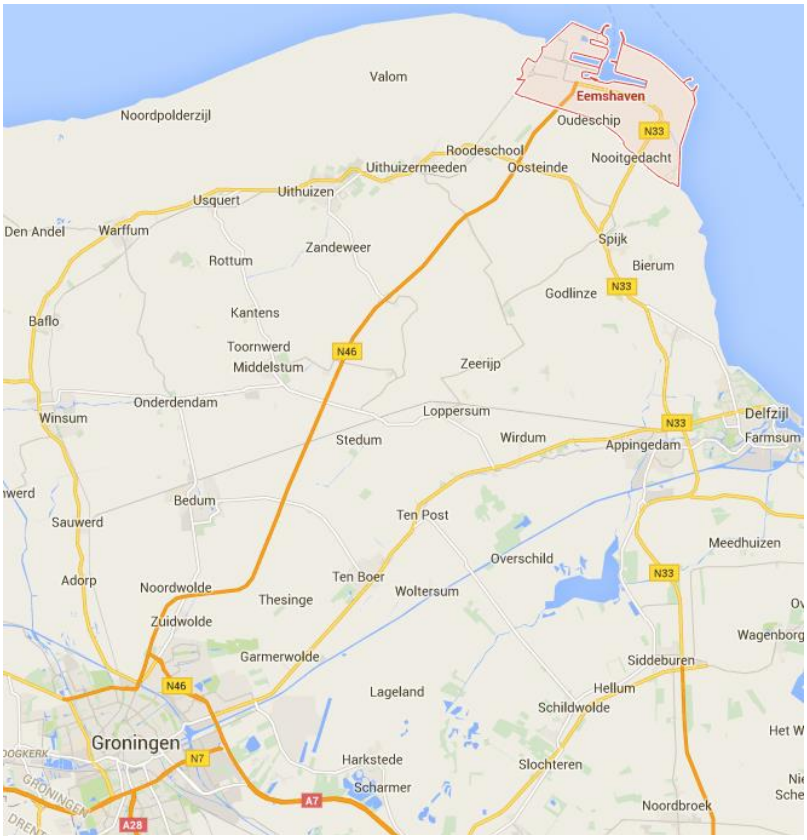


Figure 4.2 Eemshaven in the province Groningen (Google, 2016)

The access to the Eemshaven is quite good. The N46 provides a direct connection to Groningen city and the N33 is an important road for Delfzijl, Veendam and Assen. These roads are important transport routes for the port. Eemshaven is also connected to the railway system for freight trains. In 2018, a new extension connects the Eemshaven with the passenger train network (ProRail, 2015). Eemshaven is also accessible by Groningen Airport which is located 50 kilometres from the port.

4.1.2 Organisation

The Eemshaven is governed by Groningen Seaports (GSP), a semi government in the form of an Inc. (Groningen Seaports, 2016). Groningen Seaports is also port authority for the port of Delfzijl and adjacent industrial sites. The organisation provides the overall port services from management to development. The total area GSP has to maintain is 2600 hectares, from which 1300 is located in the Eemshaven (Groningen Seaports, 2016). GSP operates according to a market-oriented method. This means the organisation has also a department for acquisition to attract new business and companies, but also connect to new market opportunities (Groningen Seaports, 2016).

An important partner for GSP in attracting new companies to the Eemshaven is the Northern Development Agency (NOM). This organisation is an investment and development agency for the Northern Netherlands. The NOM tries to attract and maintain (international) companies to the Northern provinces and works closely together with GSP in the data sector. Both organisation recognize regional opportunities for datacentres, therefore they developed a website to inform and attract other datacentres (Dataports, 2012).

The province of Groningen exerts indirect influence on the organisation of GSP because the County Board is part of the sole shareholder which is named the Gemeenschappelijke Regeling (GR). Other members in this share are governors of the municipalities Delfzijl and Eemsmond (Groningen Seaports, 2013).

4.1.3 Types of business

Over the last few years the Eemshaven attracted different new companies which delivered a major contribution to the changing image of Groningen Seaports. Traditionally, the port had a strong position in chemistry, energy and agricultural (Groningen Seaports, 2016). Important societal changes, which can be summarized in the words “bio based” and “sustainability”, delivers new opportunities for the traditional sectors.

The chemistry sector has a strong position in the port for more than 40 years and is continuously looking for new connections to optimize processes by re-using heat, water or CO2. The network of synergy, in which companies use each other’s residues, is an attractive asset (Groningen Seaports, 2016). The energy sector in the Eemshaven consists of three power stations and huge transformer station for wind energy. The port profits of an increasing demand and attention for offshore wind energy. Near the coast of Groningen are different offshore wind parks under development. The Eemshaven has good assets and expertise to function as a service port for the maintenance of offshore wind turbines (Groningen Seaports, 2016). The agricultural sector is renewing itself by using bio based processes like biomass digester (Groningen Seaports, 2016).

4.1.4 Future perspective

Groningen Seaports wants to retain, or rather increase, the current level of investments in the ports of Eemshaven and Delfzijl. Most of the developments have a sustainable character but in order to prevent an uncontrolled growth, GSP developed a growth strategy in the port vision for 2030. The vision has a clear message: “Economic Growth = Green” (Groningen Seaports, 2012). It is clear that GSP is focussed on green, sustainable development. The most important direction of development for the Eemshaven is Energy coupled with the data sector. Energy- and Dataport are referred as basic sectors, which shows that the port authorities sees important opportunities for this area to excel in these sectors. GSP focusses on attracting businesses that strengthen the clusters, which actually means they want more datacentres (Groningen Seaports, 2012 & Dataports, 2012).

4.2 The Node Pole

This paragraph about The Node Pole organization follows the used structure of the paragraph above. In short: firstly the location, secondly the organisation, thirdly the current type of businesses in the area and lastly the future perspectives of The Node Pole.

4.2.1 Location

The Node Pole is located at the Bothnia Golf in the province Norrbotten län in the north of Sweden, as shown on figure 4.3. It is about 725 kilometres north of Stockholm and 100 kilometres south of the Arctic Circle. The Node Pole is not a strictly defined area, it consists of four municipalities which are named to the corresponding cities: Lulea, Boden, Alvsbyn and Pitea. Lulea and Pitea are directly located at the coast, both have a seaport. The port of Lulea is the largest transhipment port of Sweden. Lulea also has an airport, which is the fifth largest of Sweden. The population numbers of the cities are displayed in table 4.1. The large amount of inhabitants in Lulea is partly due to the presence of a university with about 15,000 students and 1,800 employees (Grankvist, 2016).

Table 4.1 Population numbers (City population, 2016)

City	Inhabitants city	Inhabitants municipality
Alvsbyn	4,967	8,179
Boden	18,277	27,950
Lulea	45,467	75,921
Pitea	22,913	41,579
Total	**122,123**	**153,935**

The infrastructure in the area can be characterized as a traffic hub. Different European and national highways start or end in and around Lulea. Also the railway has an important meaning with connections for goods and passengers to Norway and Finland.

4.2.2 Organisation

The Node Pole is, as stated on their website, “a region, a cluster and a support organization” (The Node Pole, 2015). The organization is a non-profit, public, agency which tries to attract and maintain businesses that operate within the data sector. The following organizations are owner of The Node Pole organization: Lulea Business Organization, Norrbotten County Council and the municipalities of Boden, Lulea and Pitea (The Node Pole, 2015). An important partner is The County Administrative Board of Norrbotten. The Node Pole organization also has (inter)national partners like Business Sweden, which is the Swedish national trade and investment organization, and the EUDCA, a European association which represents the whole data industry in Europe (The Node Pole, 2015). The Node Pole also cooperates with Cloudberry Datacentres, a research and innovation alliance for greening the data sector (The Node Pole, 2015).

The Node Pole Alliance is a network of about 80 partners with knowledge of cloud, technology, construction and management of datacentres (Graf, 2015). By clustering all kinds of needed knowledge for locating new datacentres, The Node Pole Alliance aims to shorten the period of development for new investors (Graf, 2015).

Important to mention is the partnership with SICS Swedish ICT. This organization has recently opened a research and innovation datacentre in The Node Pole to develop and test new facilities or components for the data industry. This datacentre runs in cooperation with the Lulea University of Technology (Minde T. B., 2015). This diffusion of knowledge between education and businesses could play an important role in the embeddedness of datacentres. This cooperation introduces students to business.

Figure 4.3 Location of The Node Pole (Google, 2016)

4.2.3 Types of business

The ports of Lulea and Pitea have traditionally industries with large transhipment businesses in steel and wood and paper. In particular the port of Lulea is important for the mining and steel industry because there is an important railway connection between the port of Lulea and large iron ore mines in the hinterlands. The port of Pitea transhipps wood and paper, important products for Norrbotten because about 40 percent of Norrbotten is forested. The result of this is a substantial forestry industry with corresponding pulp and paper industries (Eriksson, Facts about Norrbotten, 2010). Especially the port of Lulea transhipps a lot of iron ore which is mined in Kiruna.

The Node Pole facilitates only datacentres or affiliated companies, but within these sector different types of datacentres can be distinguished. Jonathan Koomey, expert on energy use in IT and data centres, distinguishes four different types of datacentres: “public cloud computing providers (like Amazon, Google, Facebook, and Microsoft), scientific computing centers (like those at national laboratories and universities), co-location facilities (which house servers owned by other companies), and what I call “in-house” data centers (which are facilities owned and operated by companies whose primary business is not computing)” (Koomey, 2012). At the moment ten datacentres are located at The Node Pole (The Node Pole, 2015). Only five datacentres are referred to a company: Facebook, Hydro66, KnCMiner, Fortlax and SICS ICE (The Node Pole, 2015). The type of these establishments varies across the different types. Facebook is a public cloud computing provider, whilst Hydro66 and Fortlax are collocating facilities, they rent servers for other parties. SICS ICE is a research datacentre and belongs therefore to the scientific computing centre category. KnCMiner belongs more or less to scientific computing centres. The Node Pole does not focus on one specific type of datacentre, it seems they try to attract every interested datacentre.

4.2.4 Future perspective

The Node Pole has not published a future perspective or vision document but Lulea Technology University has developed a future strategy with a corresponding mission for Norrbotten (the province in which The Node Pole is located). The mission is: “Create the leading green cool climate smart datacentre technology region” (Minde T. B., 2014). On the base of this strategy the region focusses on sustained growth with 10-20 new datacentres. The north of Sweden should be the first choice for potential datacentres. Innovation is an important keyword in this strategy. The strategy states that the region should be seen as a supply chain in which the research network, business network and The Node Pole organisation are important links in the chain (Minde T. B., 2014).

The strategy contains four concrete points. The first is to strengthen and expand the capacity of Nord Sweden to accommodate datacenters by paying attention to the process of establishment and training and development. The region should develop sustainable programs, attractive energy taxes, stronger energy security and fiber communications. The second strategy point concerns the development of a strategic marketing program in which the conditions for datacenters in Sweden are emphasized. The region should establish an ecosystem through partnership programs and a marketplace for green DC in which local and global companies from the data industry meet each other. Third point is about the business and innovation climate in Norrbotten. The region should establish an innovation environment by cooperation between organisations, with a focus on green-cold industry leadership and business development. The fourth, last point in the strategic vision is to strengthen research and knowledge structures by building test environments. These four topics should contribute significantly to the development of Norrbotten as an attractive, strong region for datacenters (Minde T. B., 2014).

4.3 Comparing Eemshaven with The Node Pole

This part of the chapter contains a comparison of the two regions based on the structure of the previous paragraphs. The four topics are showing the similarities and differences between Eemshaven and The Node Pole.

4.3.1 Location

Both areas are located at the coast, which make them attractive for the landfall of overseas data and energy cables. The location also explains the port activities in Lulea, Pitea and Eemshaven. The Node Pole is located in the province Norrbotten, which is twice as large as the Netherlands (Eriksson, Norrbotten a rich county, 2007). However The Node Pole is only part of this area, it shows the differences seizes of the two regions.

In the field of population development, Lulea in Norrbotten and Eemshaven in Groningen show, in any case until recently, somewhat similar trends. In both areas depopulation is a recognizable phenomenon, however Lulea has turned the tide. In the province of Norrbotten, a clear depopulation is visible. From 1990 – 2015 the population had decreased with 14.002 inhabitants, which means a decline of 5.3% (City population, 2016). In contrast to almost all municipalities in Norrbotten, Lulea keeps growing from 1990 until now with 11% over 25 years (City population, 2016). An important part of that growth took place in the last decade and is attributable to the rise of the data cluster that causes a growth in Lulea of 600 inhabitants every year (Nilsen, 2016; The Local, 2013). The Eemshaven is located in the east of the province Groningen, an area which is recognized for a long time as an area with population decline. The province Groningen seems to be growing, however, these growth is almost entirely attributable to the city Groningen (CBS, 2016). Just like in Norrbotten, this area shows a shrinking rural against a growing city. Both cities, Groningen and Lulea have a university with IT studies.

4.3.2 Organization

The organizational structure for developing the area as attractive for datacenters differs in many ways. The Node Pole organization is solely created to support, promote and develop the data and IT industry, only in a small part in the province of Norrbotten. Within this organization exist a strong cooperation between different municipalities and the County Administrative Board of Norrbotten (The Node Pole, 2015). In Eemshaven it is the other way round, economic development is partly governed by the NOM, an investment and development agency for three provinces, Groningen Seaports, the port authority which also has a development staff, and the province of Groningen.

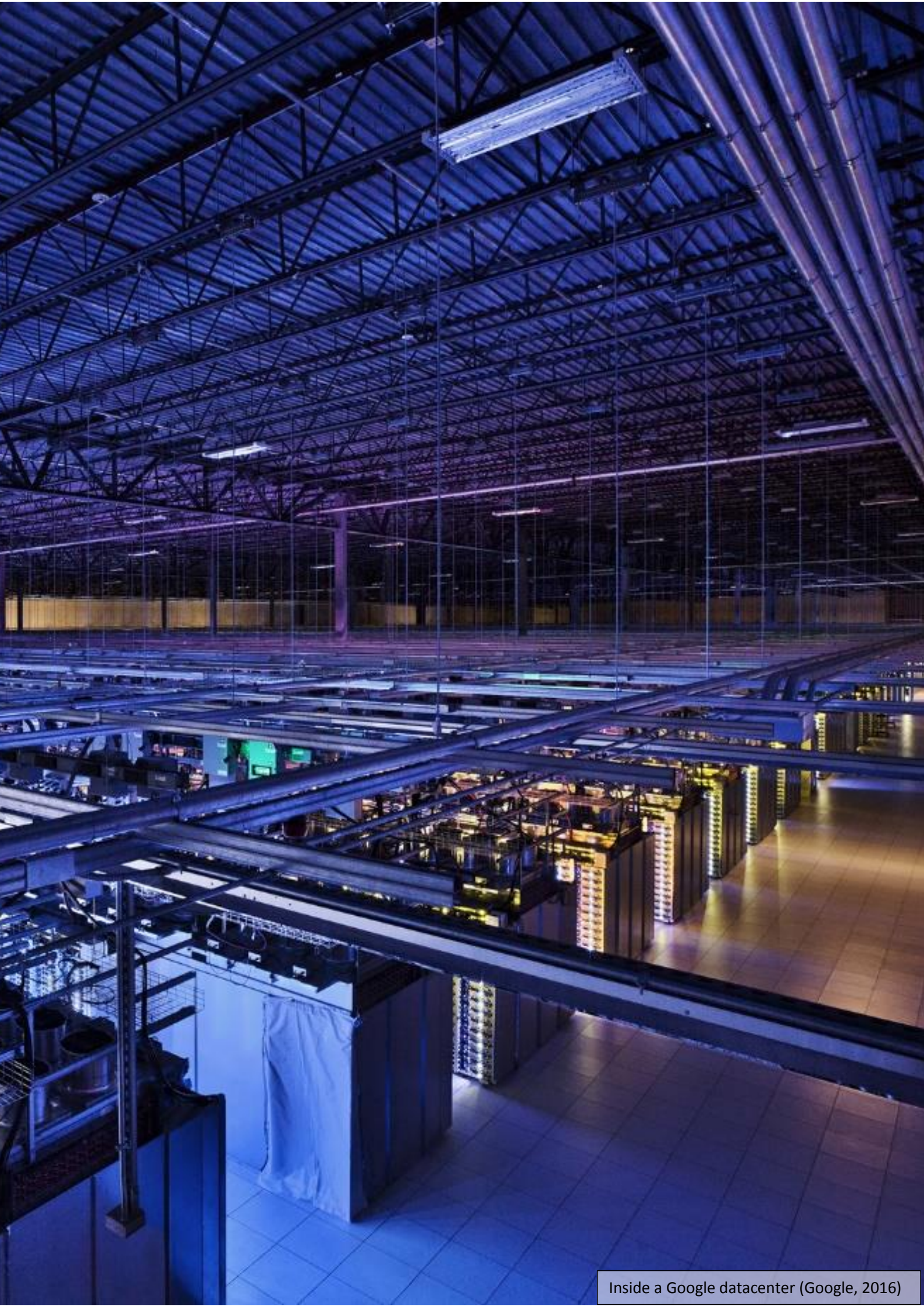
4.3.3 Types of businesses

It might be clear that both regions have their own (economic) identity. The port activities in Eemshaven differ from the type of industries in Lulea and Pitea. Important industries in the Eemshaven are chemistry, energy and agricultural, which currently develop a strong bio based character. The main industries in the ports of Lulea and Pitea are iron ore, steel production, wood and paper production.

Eemshaven has a broader focus on few economic clusters, but sees datacenters as an important future opportunity. The datacenter sector in The Node Pole is already serious industry with ten datacenters and a strong network of cooperating partners. The Eemshaven only got one existing datacenter and the Google building which is under construction. This means the data industry in The Node Pole is in another stage of sector development. Where Eemshaven is trying to link up with the global data industry, The Node Pole has already an established reputation. In contrast to the Eemshaven, the datacenters in The Node Pole are not located in, or in the direct surroundings of, the ports.

4.3.4 Future perspectives

Future perspectives of The Node Pole and Groningen Seaports differs in focus. Groningen Seaports sees important opportunities to establish and expand the possibilities for datacentres in a strong cooperation with the (wind) energy sector (Eemsdelta EZ, 2013). But Groningen Seaports has also much attention for other sustainable developments e.g. the chemical cluster, recycling and logistics (Groningen Seaports, 2012). The surroundings of Lulea, Boden and Pitea seems to have stronger focus on attracting and maintaining new datacenters or related companies. This is in accordance with the policy of the Swedish authorities which are more and more interested in high-tech IT and data industries. The arrival of Facebook in 2011, formed the basis for a slow but steady shift from more traditional industries towards a modern data and IT industry in the area of The Node Pole. This shift is supported by the Swedish government that acknowledged the tech industry as an important economic sector for their national economy (Deutscher, Lind, Sundström, & Warrenstein, 2016). As stated, the Eemshaven has a more diverse economic profile until now, but the arrival of Google is reason for Groningen Seaports, the NOM and the province to give much attention to this new potential economic sector. This reaction is comparable to the strategy of the local and regional governments in the Nordics when Facebook announced their establishment. This shows that the arrival of TNCs causes an awakening and awareness of their regional qualities.



Inside a Google datacenter (Google, 2016)

5. Results

In this chapter, all propositions as given in chapter 2.8, are investigated based on the interviews. Every subchapter discusses a proposition, except chapter 5.1 which is an introduction to the results. Every subchapter that discusses a proposition has a fixed order. The first part investigates the situation in Groningen, the second investigates the situation in The Node Pole. The last part always gives a conclusion and an answer to the proposition.

5.1 Introduction of the results

This subchapter discusses the impact of the arrival of both Google in Groningen and Facebook in The Node Pole. It gives insight into the premises of the establishment and the impact on e.g. the regional economy.

5.1.1 The impact of Google's arrival

At the 26th of September 2014, minister Kamp announced the arrival of a huge datacentre. During a press conference in the Eemshaven, many journalists from national media heard that is not Apple, as many media predicted, but Google who is going to build a datacentre in the Eemshaven (Dagblad van het Noorden, 2013). Google bought 44 hectares and planned an investment of €600 million. 2016 should be the year in which the first phase is operational, they stated in 2014 (Groningen Seaports, 2014).The presence of minster Kamp, Google's Data Center Design manager Bryan Evans, the director of Groningen SeaPorts and other Senior Officials underlined the importance of this investment in Groningen. Especially for Groningen this is an important investment because the province suffers from long-term problems as earthquakes due to gas extraction, high unemployment and a fragile liveability due to population decline. Especially, the increasing amount of earthquakes were problematic for the image of Groningen. Time after time, the national news broadcasted items about the results of gas extraction, which were often accompanied with desperate stories of residents. With this in mind, what is the impact of Google's announcement?

That the investment of Google was a serious foreign capital injection in Groningen, and also the Netherlands as a whole is shown in figure 5.1. This figure shows an overview of foreign investments in the Netherlands in € million by year. 2014 shows a massive peak, much higher than the average curve, due to the investment of Google (NFIA, 2015). However many persons involved were pleased with the establishment of Google in Groningen, the concrete benefits were still a bit vague. It was not clear which number of jobs the datacenter exactly constitutes, if these jobs could be fulfilled by locals or not, and other questions about regional benefits.

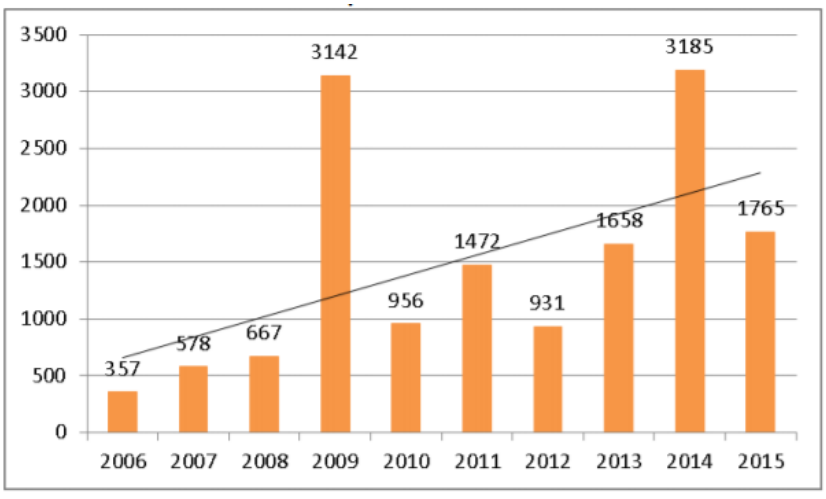


Figure 5.1 The amount of foreign investment in € million over 2006-2015 (NFIA,

Two years after the official announcement Google and running up to the opening, involved parties already observe benefits for the Eemshaven and for Groningen. The most prominent benefit appointed in the interviews is the large positive impact Google generated for the Eemshaven and the province. A representative of Groningen SeaPorts: "in a period in which more or less a climax emerged around the earthquake dossier we showed, as region, that you can attract such a large IT concern as Google, which makes very responsible business decisions" (Representative Groningen SeaPorts, personal communication, May 30th, 2016). The same respondent stated that Google gave the Eemshaven a two-dimensional boost. After the Google decision, regional and national companies of all kind of businesses wanted to establish in the Eemshaven, without having good business reasons for being in the Eemshaven. This is also recognized by a representative of Eemsdelta EZ which saw increasing interest in the acquisition of SMEs after years of problematic acquisition (Representative Eemsdelta EZ, personal communication, May 26th, 2016). The second dimension of the boost given by Google is located in the international branding in the IT sector. "When we visit Silicon Valley, actually we do not have to explain where the Eemshaven is located" (Representative Groningen SeaPorts, personal communication, May 30th, 2016). Also other respondents emphasize the attractiveness of the Eemshaven now Google showed the excellent establishment conditions for datacenters or energy intensive industries (Representative EBG, personal communication, May 30th, 2016; Ex-representative province of Groningen, May 23th, 2016).

In general, the respondents from Groningen cannot identify any disadvantages of the arrival of Google's datacenter. Only in the planning process some questions raised. The decision of Google to build a datacenter in the Eemshaven was dependent on an important element, namely the site location. In the Eemshaven is a total amount of 170 hectares land available for the construction of new industries, but all these sites are located outside the dikes (Representative municipality Eemsmond, personal communication, May 27th, 2016). Google wanted to minimalize risks for maximizing their continuity. Flood is an important risk for Google to take into account. Therefore Google only wanted to build the datacenter behind the dikes. This meant the government had to develop a new industrial area which originally had an agricultural destination (Representative municipality Eemsmond, personal communication, 27th 2016). This decision led to a lack of understanding at some parties in Groningen.

The announcement of Google underlined the regional strengths which not everyone was aware of before. In particular the physical conditions for datacenters are very well organized in the Eemshaven. Generally, the physical infrastructure is seen as the most important reason for Google to establish in Groningen, above intellectual infrastructure and well-organised laws and regulations. "The physical conditions are condition sine qua non" (Representative Energy Valley, personal communication, May 27th, 2016). Important part of the establishment conditions is the availability of a variated energy mix which ensures that Google can claim several sources. As a result, there is a reliability of supply of almost 100% (Ex-representative province of Groningen, May 23th, 2016). But also the peripheral location and a transatlantic fibre connection are seen as important elements that made Eemshaven attractive for Google.

5.1.2 Impact of Facebooks establishment in Lulea

In October 2011 Facebook announced they were going to build their first datacenter in Europe. This datacenter turned out to be very important for Facebook, it became the largest datacenter ever built in Europe and also the northernmost datacenter on earth (The Node Pole, 2011). Some numbers: the direct investment in the build of the datacenter is approximately €415 million, the accumulated economic impact on Sweden is €935 million over ten years, in the same timeframe the datacenter generates 4,500 direct and indirect jobs in Sweden (The Boston Consulting Group, 2014).

During the press release from Facebook different governors tried to underline the good location factors in northern Sweden. The fact that a huge company as Facebook choose for their area was a very important signal for both the Mayor, the County governors and the National Minister of Enterprises. Not only the fact their region has attention of TNC"s was noticed but also the type of industry was seen as remarkable. Mayor of the City of Lulea: "Facebooks datacenter in Lulea marks the beginning of a new era, as we are now entering a digital industrial age" (The Node Pole, 2011). This shows that the rise of the digital world opens new possibilities for nonurban areas which were often struggling with economic back lag against urban areas. Reactions to the announcement from Google in Groningen contained the same elements of pride and assigning new functions for the rural area in Groningen. The build of Google's datacenter shows that "this area has a lot to offer for international IT- and internet companies" (NOS, 2016).

The rise of the datacenter cluster in northern Sweden is definitely attributable to the arrival of Facebook. "Facebook already did background research to this place and decided based on that research to establish, this makes it easier for others to follow" (Representative Lulea University of Technology, personal communication, August 25th, 2016). The notion that "other companies may follow the same way as Facebook" to Lulea was the reason for different partners in the area of Lulea to communicate the favourable business location factors (Representative The Node Pole, personal communication, August 16th, 2016). This led to the rise of The Node Pole organisation.

The founding of The Node Pole organisation was a direct result of the announcement of Facebook and took place at almost the same day as the press release of Facebook (Representative The Node Pole, personal communication, August 16th, 2016). Lulea, surrounding municipalities and the County Norbotten felt the urgency to create a brand instead of using the name of the County or the region for selling their unique conditions. The brand and its corresponding platform wears a name that is not directly connected to the geographic area of Lulea. The Node Pole is "a place in the world where datacenters can be established", a place which is equipped with "key factors and knowledge about bringing investments to this part of the world" (Representative The Node Pole, personal communication, August 16th, 2016).

The fundamental reason of Facebooks decision to establish in Lulea are the running costs. These costs are to a large extent dependent on physical characteristics, like: climate, power and internet connections. Running costs are the way to compete: "if you cannot serve for a good cost than you are out of the game" (Representative of The County Administrative Board, personal communication, 28 September 2016). Of course in processes like these many variables play a role but first of all datacenter companies are comparing new sites on the costs of the most important establishment elements. In Lulea the costs are low because of the optimal conditions of the physical infrastructure: environmental cooling, renewable energy and available land (The Node Pole, 2011). At the same time it is clear that datacenter companies have seen the added value of other amenities in The Node Pole.

The arrival of Facebook has pointed out the importance of intellectual infrastructure for The Node Pole organisation. However, physical infrastructure is conditionally for establishing but for the long term intellectual property is very important (Representative The Node Pole, personal communication, August 16th, 2016). Building a cluster in the datacenter industry cannot happen without local knowledge, technicians, engineers and innovation. These elements are necessary for renewing companies" facilities, attracting new datacenters or expanding existing facilities (Representative The Node Pole, personal communication, August 16th, 2016). Since Facebooks establishment The Node Pole organisation observes a growing awareness of the importance of a well organised intellectual infrastructure. This is among others reflected in the start of the Cloudberry datacentre research and

innovation project, coordinated by the Lulea University of Technology (Representative Lulea University of Technology, personal communication, August 25th, 2016).

The settlement of Facebook also has effect on the local society in The Node Pole region. Inhabitants see the company as a big international body but Facebook tries to connect themselves with the inhabitants in different ways (Representative The Node Pole, personal communication, August 16th, 2016). For kids they organize a design contest, for youth and adults they have specific programs to stimulate entrepreneurship and foster IT knowledge. And they are also involved in research projects at the Lulea University of Technology (Representative of The County Administrative Board, personal communication, 28 September 2016).

Figure 5.1 2,500 inhabitants of Lulea form a "like" symbol (Wolford, 2013)

5.2 The influence of power plants on Google's embeddedness

What oxygen is for human, is electricity for datacenters. Which means power is absolute conditionally for datacenter sites. In contrast to oxygen, electricity is not everywhere available and not at all when it comes to a strong, reliable connection. Datacenters need to have a 100 percent secure energy supply because the user requested data should be available at any moment. To reach this level of supply security almost every datacenter has a redundant energy connection and backup generators. When power is that important, is it then of importance that power resources are in the vicinity of datacenter locations? Because power can be transported over long distances the proximity of power plants to datacenters is perhaps not of big importance for a good climate in which datacenters will embed. This chapter describes the results of the following proposition: The proximity of (green) energy plants exerts direct influence on the embeddedness of Google's datacenter.

5.2.1 Energy and datacenters in the Eemshaven

There is no doubt about it that the presence of a diversified and huge supply of power, both renewable and non-renewable, was one of the most important conditions for Google to see Eemshaven as a serious site (Representative of Groningen SeaPorts, personal communication, May 30th, 2016 & Representative of Energy Valley, personal communication, May 27th, 2016). The supply of non-renewable energy is assured by three power plants. Engie has a gas-fired plant generating 2,400MW, Nuon has a multi fuel plant which generates 1,300MW and the third is a coal plant from RWE generating 1,600 MW (van Tuinen, Follow the Energy: Green Dataport Eemshaven, 2015). These plants are less than five kilometres from the Google datacenter located. With other words a high efficient and strategic location for a datacenter. The shorter the transport distance of energy, the less the transport loss of energy (Ex-representative of County Council Groningen, personal communication, May 23th, 2016). Considering the amount of energy a datacenter uses, it is beneficial to locate near power plants. Furthermore, the power supply security for a datacenter should be 100 percent. Only just the proximity of three different power plants guarantees an extremely high degree of supply security.

Despite the importance of availability and proximity of power plants, non-renewable energy does not match the sustainable demands Google has upon energy. Google demanded that their datacenter should use renewable, geographic traceable power from the first day. This condition could be fulfilled

with a scheduled wind farm owned by Eneco at only eight kilometres away from the datacenter site (Representative of Energy Valley, personal communication, May 27th, 2016). However, it is questionable if Google has only established their datacenter because of this wind farm.

There are more possibilities when it comes to power sources in the Eemshaven. It is not for nothing that Groningen SeaPorts promotes Eemshaven as a green dataport, the place for datacenters (van Tuinen, Follow the Energy: Green Dataport Eemshaven, 2015). The Eemshaven has a converter station for the cable connection with Norway, the so called NorNed cable by which hydroelectric power is transported to the Netherlands and if necessary Norway can buy power from the Netherlands by the same cable (van Tuinen, Follow the Energy: Green Dataport Eemshaven, 2015). Furthermore, the COBRAcable, an undersea power connection between Denmark and the Netherlands, is under construction at the moment. This is 700MW cable is mainly meant for wind power from Denmark to the Netherlands via the converter station in Eemshaven (TenneT, 2016). However, Eemshaven and its surroundings have a lot of on- and offshore wind power by themselves. Figure 5.2 shows nine present and future wind farms with over 2100 MW wind power including the COBRAcable.

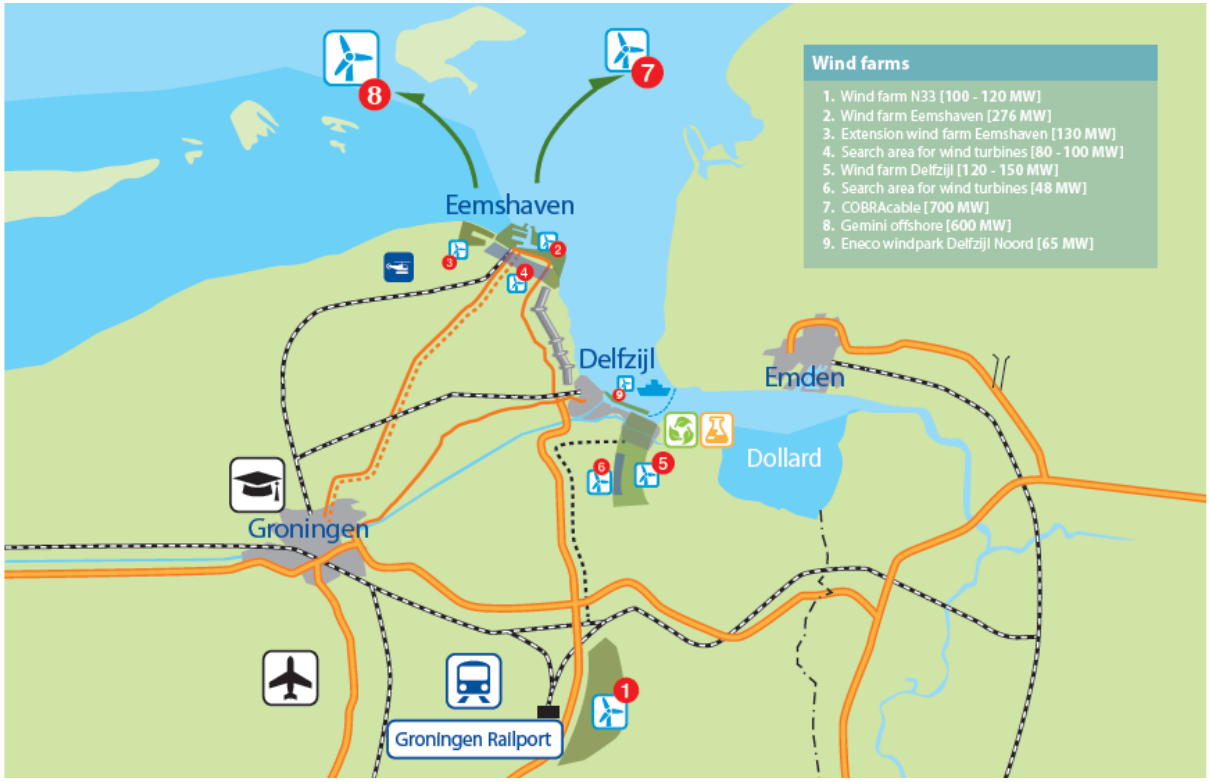


Figure 5.2 Present and future wind farms (Groningen SeaPorts, 2017)

It is the unique mix of power sources in the Eemshaven that has attracted Google, more than only the power plants or the availability of renewable power (Representative of Groningen SeaPorts, personal communication, May 30th, 2016). The mix consists of renewable power, three non-renewable power plants and the clean power connection with Norway (and Denmark in the near future). The renewable power makes it possible for Google to meet their sustainability goals. Google is aware that clean energy is not available continuously because this is influenced by weather conditions. Because datacenters need a stable, continuous amount of power, Google is dependent on power plants (Representative of VNO-NCW MKB Nederland, personal communication, May 30th, 2016). For this reason Google uses Power Purchase Agreements (PPA). Google wants to buy local, clean power from an energy producer that is immediately resold to the regular electricity grid. For this energy Google gains Renewable

Energy Certificates (REC's) that they apply to the non-sustainable energy used in the datacenter (Google, 2017).

Having so many different energy sources in a small area is an undeniable pull factor for datacenters in general, but the focus in energy production needs to shift even more to clean power (Representative of Energy Valley, personal communication, May 27th, 2016 & Ex-representative of County Council Groningen, personal communication, May 23th, 2016). Datacenter companies acknowledge their responsibility for clean energy, so the availability of this is essential for attracting more datacenters. This is confirmed by a representative from Eemsdelta EZ who stated that the Eemshaven already lost a potential datacenter because the availability of clean power could not be guaranteed (personal communication, May 26th, 2016). In order to prevent this Eemshaven should must constantly attract new investors in clean energy to strengthen their position as green port.

5.2.2 Power in The Node Pole

Power in The Node Pole has never been an issue because there is a strong, reliable grid with a continue supply of energy from hydro power stations, which is used by the strongly represented paper and steel industry (Representative of RISE ICT, personal communication, September 23th, 2016). Although, there is enough renewable power in The Node Pole the urgency for sustainability in datacenter companies has not remained unnoticed in Lulea and its surroundings. All over the world datacenter companies invest in wind parks and solar parks, in the North we have hydro power combined with a cold climate which is efficient for cooling, it is clear that datacenter companies are sensitive for these circumstances (Representative Lulea University of Technology, personal communication, September 23th, 2016). The cold climate brings efficiency in the process of cooling, the availability of 13 hydro power stations guarantees a secure, redundant power connection and the environmental impact is low (Representative of the County Administrative Board, personal communication, 28 September 2016).

The Node Pole organisation tries to communicate that they have more than only plenty of clean power. Power is important but is also almost everywhere on earth available. "Yes we have renewable energy but we know that many competitors in the world also have renewable energy" (Representative of The Node Pole, personal communication, August 16th, 2016). Within the framework of energy, The Node Pole area see its unique selling point in the availability of many clean energy, triple redundancy and a very reliable grid (Representative of RISE ICT, personal communication, September 23th, 2016). But The Node Pole as a whole is more than a place with clean power. The physical conditions and the intellectual infrastructure together creates a strong whole.

5.2.3 Findings

As expected, the proximity of power plants does influence the embeddedness of Google's datacenter. But, it is not only the proximity of energy plants itself but even more the total of available energy sources (renewable and non-renewable) in the Eemshaven which makes it very attractive for datacenters to establish. Due to this mix datacenter companies can opt the type of energy that fits to their needs. The case of Google shows that it is possible to combine local, renewable energy together with the reliability of the non-renewable plants.

The most important lesson from The Node Pole is the way power benefits are communicated. The Node Pole organisation knows that their supply of power is absolutely key for large companies. But they use it as one of the physic components that together with other physic and intellectual component form a whole. Renewable power in itself is no longer a unique selling point. For Eemshaven the communication is currently too much fragmented and mainly focussed on physic conditions instead of a whole set of benefits.

5.3 The importance of overseas data cables

With the continuous growth of wireless connections with all kind of devices, many people think the internet also has become wireless. The opposite is true. Due to a large amount of cable packages the internet exists. Countries and continents are connected to each other by internet exchanges and transatlantic internet cables. Within the whole network datacenters have an import role as physic repository of everything of what the datacenter company wants to store. For this reason it is imaginable companies' wants to have their datacenters as close as possible to the landing points of important transatlantic cables. Eemshaven is landing port for one of the many transatlantic cables, the so called Tyco cable. But, is the presence of this cable influencing the choice of datacenters to establish and embed in Eemshaven? The proposition is as follows: The proximity of transnational, overseas data cables are of interest for the embeddedness.

5.3.1 The importance of the Tyco cable

It is obvious that the presence of the Tyco cable has played a role in Google's decision to establish in Groningen (Representative University of Groningen, personal communication, May 26th, 2016; Representative of Energy Valley, personal communication, May 27th, 2016; Representative of Groningen SeaPorts, personal communication, May 30th, 2016). Proximity to the internet highway and to the end-user is important if you want to transport something because it lowers the latency. Latency is the time to deliver data between two locations. This means locations of datacenters are strategic decisions. The Tyco cable is part of the highway because it is an important cable for west-Europe (Representative Eemsdelta EZ, personal communication, May 26th, 2016). The cable origins from 2001 and is, via England, connected with the United States (Groninger Internet Courant, 2001 & Representative Groningen SeaPorts, personal communication, May 30th, 2016). Tyco is part of the backbone of the worldwide fiberglass network and from this perspective an important facility for the establishment of datacenters in the Eemshaven. It is clear that Groningen SeaPorts understands that the presence of the Tyco cable is important for attracting new datacenters because it has a prominent place in their communication (Groningen Seaports, 2016).

At the same time, there are more important internet cable connections in the Netherlands than only the Tyco cable. Especially on the west coast of the Netherlands because of the Amsterdam Internet Exchange, the biggest Internet Exchange in the world. Figure 5.3 shows an overview of the concentration of connections near Amsterdam. Because of the amount of connections, and the important Internet Exchange Amsterdam is a popular location for specific types of datacenters, for example for stock trading and financial institutions. But, according to a representative of Groningen SeaPorts, Eemshaven does not want to attract this colocation datacenters which are looking for least latency as possible (personal communication, May 30th, 2016). Eemshaven tries to respond to the trend that more and more public cloud providers (e.g. Amazon, Facebook) are locating their datacenters in rural areas, in particular because the fibre connection is excellent (Jones, Hillier, & Comfort, Data centres in the UK: property and planning issues, 2013).

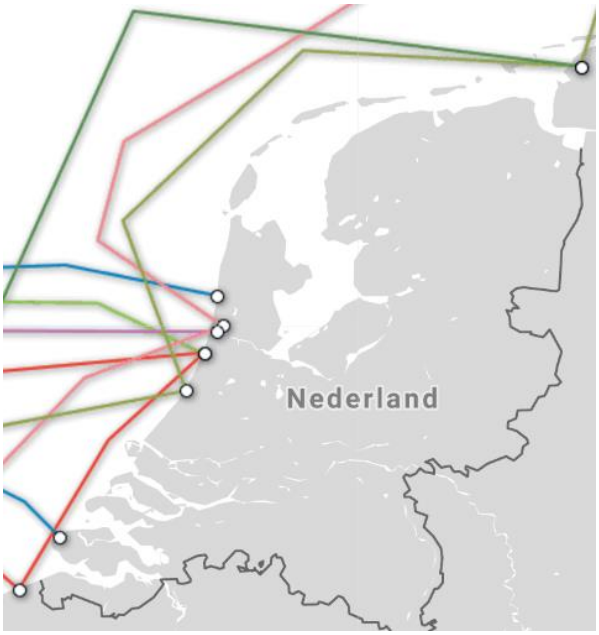


Figure 5.3 Overview of transatlantic connections in the Netherlands (Submarine Cable Map, 2017)

Groningen SeaPorts recognizes the importance of improving connections with the backbone in order to strengthen their location benefits for the long term. Given the value that is attached to fibre, improving the fibre is important for the embeddedness of datacenters. For this reason Groningen SeaPorts is consulting with different partners to add standard fiberglass to new power cable connections with other EU countries (Representative of Groningen SeaPorts, personal communication, May 30th, 2016). This strengthens the position of Eemshaven among the current important countries for datacenters: Ireland and the Nordics. From a geographic perspective Eemshaven is a logical place for a data hub between these areas. This strategy shows that Groningen SeaPorts is aware of the importance of high quality physical establishment conditions for the long term.

5.3.2 Latency at The Node Pole

The Node Pole area shows that fast connections to the backbone of the internet are important for datacenters but is not always top priority (Representative of the County Administrative Board, personal communication, 28 September 2016). With about ten datacenters The Node Pole is one of the northernmost datacenter clusters in the world and that is not without reason. According to representatives of The Node Pole organisation and the County Administrative Board the current cable infrastructure is good but the latency is, due to the geographical location, quite a problem (personal communication, August 16th, 2016; personal communication, 28 September 2016). The means that the possibilities to reduce the latency are limited to the creation of more efficient cable connections, which is also being considered at the moment (Representative of The Node Pole, personal communication, August 16th, 2016). Despite the adverse effect of latency, The Node Pole shows this does not have to be a problem in attracting more datacenters.

The fact that all respondents from the Nordics spoke about latency as adverse effect shows it certainly affects their international competitiveness. Even the fact that The Node Pole is involved in a future project to create an Atlantic cable above Scandinavia, Russia and Greenland underlines the importance of good connections from datacenter sites to the world (Representative Lulea University of Technology, personal communication, August 25th, 2016). The Node Pole organisation confirmed that continuously improving the area is important: “we have to constantly develop our solutions and sites to meet the demands from the big companies” (Representative The Node Pole, personal communication, August 16th, 2016).

5.3.3 Findings

The proximity of transnational data cables near datacenter sites are certainly of interest for the arrival and establishment of datacenters. Datacenters are dependent of these cables, therefore the location matters. Different respondents from the Eemshaven recognize the importance of the Tyco cable and stated that the cables presence is clearly one of the reasons Google decided to establish in Eemshaven. But just like power, fibre connections are one of the several important location conditions. The Node Pole is a good example which shows that datacenter companies have to make decisions between different important topics. In this case fibre connections are good but probably not as good as in the Eemshaven. The fact that datacenters dare to choose for a location with more latency than others, means that several factors determine the whole. But still, respondents from, and upcoming investments in both areas confirm the importance of excellent fibre connections. To remain attractive in the long term for new data companies and further embed existing datacenters, it is important to continue investing in the cable infrastructure.

5.4 Proximity of cities and their infrastructure

Large datacentres are often located in rural areas. Eemshaven is not the only examples of this, also in the United States are similar examples like Prineville, a small town where Facebook and Apple have large datacenters. Datacenter companies seem to have good reasons for their choice to establish in the rural but may have more interest in the presence of cities and their infrastructure than expected. Despite the fact that Google's establishment can be easily interpreted as a cathedral in the desert, the proximity of Groningen city and associated transport infrastructure can make the desert smaller than expected. This subchapter discusses the following proposition: The proximity of a city and, corresponding to that, good accessibility of the area has influence on the embeddedness of (Google's) datacenters.

5.4.1 The proximity of Groningen city

Eemshaven is a location that is meant for work, transport and industry and therefore requires good infrastructure connections (Representative of VNO-NCW MKB Nederland, personal communication, May 30th, 2016). Groningen city is 35 kilometres located from Google's datacentre, which is 30 minutes by car (Google, 2017). This is the closest place that houses essential amenities in the field of culture, housing and a diverse range of shops and restaurants, see also figure 5.4. The road connection between Eemshaven and Groningen city is quite good, which also applies to the connection with other cities (Representative of VNO-NCW MKB Nederland, personal communication, May 30th, 2016).

The importance of a good road infrastructure for improving the Eemshaven as a better work location is partly recognized. A representative of VNO-NCW MKB Nederland stated that: "you just need physic infrastructure to make the area function as an optimal work location" (personal communication, May 30th, 2016). Thus, the presence of good infrastructure is conditionally for the economy. This is confirmed by a representative of Groningen SeaPorts: "infrastructure comes first and then follows economy and thus also industry" (personal communication, May 30th, 2016). For Eemshaven this means there must be a clear vision with shared support of all stakeholders about the potency of the area.

From an international perspective, Groningen Airport Eelde could be an important facility, because Google will receive foreign visitors or employees on a regular basis. However, Groningen Airport is a small one, it has a good connection with London. Since September 2016 the airport has an important line connection with the international airport of Copenhagen (Groningen Airport Eelde, 2017). This creates more added value, expands the accessibility of the Eemshaven and is important for expats of international companies in Groningen (Representative of Groningen SeaPorts, personal communication, May 30th, 2016). Although the final effect of this new connection is not yet visible, it contributes to better accessibility.

The airport strengthens the regional accessibility, but according different respondents from Groningen, the extent to which the area is accessible will not have a major impact on the arrival or passing of datacenters (Representative of Energy Valley, personal communication, May 27th, 2016; Representative of Eemsdelta EZ, personal communication, May 26th, 2016 & Ex-representative of County Council Groningen, personal communication, May 23th, 2016). In terms of infrastructure, the airport seems to be an important facility, more than roads and railways but respondents still do not have much attention for Groningen Airport in their answers.

Figure 5.4 The city enter of Groningen (Aheroy).

The proximity of Groningen city, see figure 5.4, certainly had impact on Google's decision to establish in Eemshaven than the presence of a good infrastructural connections (Representative of Energy Valley, personal communication, May 27th, 2016). It is expected that Google employees will come from the Northern Netherlands as well as from abroad. Especially for the latter, the presence of a city is an important feature. In this case Groningen offers important amenities for (international) knowledge workers like, variety of residential facilities, different kind of shops, a historic city center with many cultural facilities, restaurants and an international school in the direct surrounding of the city (Representative of Groningen SeaPorts, personal communication, May 30th, 2016 & Representative of Eemsdelta EZ, personal communication, May 26th, 2016). Also the presence of an international welcome center delivers a positive contribution for the establishment of expats.

5.4.2 The advantage of cities in The Node Pole

The importance of the level of accessibility is widely recognized by respondents from The Node Pole area. At the same time, the condition of good accessibility is perceived as less important in site ranking than power and internet cable connections. Based on experience with several datacenters in The Node Pole, it is confirmed that companies in their final, decisive round compare potential sites among other things on accessibility. At that moment, sites with a less attractive offer of power or cable connections have already disappeared from the shortlist with potential locations (Representative of RISE ICT, personal communication, September 23th, 2016).

The Node Pole knows that they are certainly not in the center of the world and therefore recognizes the importance of an excellent infrastructure to expand their cluster (Representative The Node Pole, personal communication, August 16th, 2016). Large datacenter companies have locations in different continents, so they need good infrastructural connections, especially with airports. At Lulea Airport, thirteen aircrafts land every day arrive from Stockholm, which is one hour's fly (Representative County Administrative Board, personal communication, August 16th, 2016). Because of the location up in the north, Lulea is dependent on their airport when it comes to accessibility. Therefore, connections with international hubs are crucial. However the connection with Stockholm is good, this is, in contrast to e.g. Copenhagen, not an international hub.

The Node Pole has reasonably good flight connections with other cities and countries but respondents from The Node Pole are aware of their disadvantageous location and recognize this as an important element where improvement is required (Representative Lulea University of Technology, personal communication, August 25th, 2016). When regional basic conditions are good, the next step is to improve and strengthen the secondary conditions to make the cluster more attractive (Representative of RISE ICT, personal communication, September 23th, 2016).

The proximity and presence of cities in the surroundings of datacenters are also in The Node Pole recognized as important (Representative County Administrative Board, personal communication, August 16th, 2016; Representative The Node Pole, personal communication, August 16th, 2016). Not only the offer of daily and cultural amenities are seen as relevant but especially the presence of the university is seen as a crucial facility in the city of Lulea. The university of Lulea is located on walking distance from the Facebook datacenter (Representative The Node Pole, personal communication, August 16th, 2016). The knowledge contribution of the university of Lulea is perceived as important in attracting new datacenters and reinforcing the cluster.

In the case of Lulea, the established datacenters do not benefit unilaterally from the city, Lulea also benefits from the arrival of Facebook and other datacenters. Since the presence of the datacenters the amount of applies in computer science at Lulea University has increased (Harding, 2015). The arrival of new students is only part of the growth of Lulea with 600 new inhabitants per year (Nilsen T. , 2016). Also new restaurants and hotels have emerged, due to the rise of the data cluster (Harding, 2015). These effects shows that datacenters are not necessarily cathedrals in the desert.

5.4.3 Findings

The Node Pole and Groningen both show that the presence of a city, its corresponding accessibility and facilities matter for the establishment of datacenters, which confirms the proposition. The extent to which this factor plays a role should not be overestimated. It is particularly seen as a secondary condition. Power and internet connections are seen as most important conditions for establishing. In the long term, it is important that Groningen and its surroundings have facilities that match the needs of expats. A high quality of life for expats and local employees as well, is an important element for the embeddedness of the datacenter. Furthermore, excellent flight connections with international hubs are seen as an important condition. Groningen has recently had the benefit of being connected to an important international hub, Copenhagen airport. The importance of excellent accessibility as a condition for embeddedness is more recognized in The Node Pole than in Groningen. This is a point of attention for Groningen.

5.5 Intellectual against physical infrastructure

Embedding companies in an area or a cluster is always dependent on different elements. In the past subchapters the most important physical elements are already discussed. These paragraphs indicate that the presence of different physical elements is important to establish a datacenter or not. Beside physical elements also other topics can play an important role in the further embeddedness of data companies, for example the availability of knowledge, students and companies with related technical solutions or IT services. These, so called intellectual infrastructure, is possibly more important for a well-embedded cluster than expected at first sight. For Groningen it is important to know which topics should have their attention in building an embedded cluster. Therefore this subchapter discusses the following proposition: For a well-embedded datacenter cluster, physical infrastructure is more important than intellectual infrastructure.

5.5.1 The physical potential of the Eemshaven

In this stadium of the cluster, physical infrastructure seems to be more important than the intellectual infrastructure for the Eemshaven and the case of Google. According to a representative of Energy Valley the physical conditions are “conditio sine qua non” (personal communication, May 27th, 2016). Also others share the opinion that physical infrastructure, especially proximity to power resources and the availability of land, has been leading for the decision of Google, and that this always will be leading for equivalent companies (Ex-representative of County Council Groningen, personal communication,

23thth May 2016; Representative Eemsdelta EZ, personal communication, May 26th, 2016 & Representative of Economic Board Groningen, personal communication, May 30th, 2016). A representative of Eemsdelta EZ thinks knowledge institutions have had little influence on the arrival of Google. "If knowledge institutions were not here, and this proved to be the best place, except this topic, they would have organised a knowledge institution by themselves (Representative Eemsdelta EZ, personal communication, May 26th, 2016). According to a representative of Energy Valley, the same applies to labour. There is qualified labour available in Groningen, but if that is not enough, qualified people can also be brought here (*personal communication,* May 27th, 2016).

An important note is that the type of datacenter matters to the extent in which intellectual of physical infrastructure is leading (Representative University of Groningen, personal communication, May 26th, 2016). Datacenters like Google are fully self-sufficient and they are run as factories, because of this they are not dependent on regional knowledge structures companies (Ex-representative of County Council Groningen, personal communication, 23thth May 2016). This type of datacenter needs more or less a one-sided type of work, namely electrical maintenance engineers. These datacenters operate according fixed and generic principles as determined by the headquarters. That could be one of the reasons for Google why the focus is on physical infrastructure more than intellectual infrastructure (Representative University of Groningen, personal communication, May 26th, 2016). Scientific datacenters or establishments with a focus on development would have more interest in highly educated staff and relations with knowledge institutions. For Groningen this means building a strong data cluster could be reached by attracting a diverse range of datacenters.

The predominant conviction that Groningen is especially attractive because of excellent physical infrastructure for datacenters can also be recognized in the used topics in promotional materials. The Northern Development Company and Groningen SeaPorts, the most important regional players in attracting new companies, only use physical infrastructural elements in their marketing and promotional material (Van Tuinen, 2015; Groningen SeaPorts, 2016; NOM, 2014).

5.5.2 Leading infrastructure in The Node Pole

Involved persons in The Node Pole are aware of the rapidly increasing importance of the presence of intellectual infrastructure. Still, the physical infrastructure is a crucial element in taking the decision to establish or not. Power and fiber connections again are seen as the main drivers for settlement because these elements enable efficiency benefits for running a datacenter at the lowest costs (Representative of RISE ICT, personal communication, September 23th, 2016; Representative The Node Pole, personal communication, August 16th, 2016). This is clearly underlined by a representative of the County Administrative Board: "I think the most important part for every datacenter comes down to money. If you can't serve for a good cost than you are out of the game. If we take that at something that is always needed in every datacenter establishment, they try to find the most bang for the buck" (personal communication, August 16th, 2016). Thus, to be an attractive and competitive establishment area for datacenters it is indispensable to have a strong physic infrastructure. But, according to respondents from The Node Pole region, this is just the start of building a cluster.

During the research it became clear that an area needs a strong physic infrastructure for attracting datacenters but for maintaining and interweave them in a cluster, a strong intellectual infrastructure is essential. The arrival of Facebook in Lulea attracted more datacenters to The Node Pole. The fact that the establishment of other datacenters proved successful, is largely due to the presence of intellectual infrastructure. Facebooks arrival gave others the trust and proof that physic infrastructure should be good, but the functioning of a successful cluster is also dependent of other elements (Representative The Node Pole, personal communication, August 16th, 2016). When an area wants to add more datacenters to an existing datacenter concentration, there has to be a certain level of

intellectual infrastructure (Representative Lulea University of Technology, personal communication, August 25th, 2016).

New potential companies are less likely to settle in a certain area, when there is a lack of appropriate technicians, engineers and IT specialists (Representative of RISE ICT, personal communication, September 23th, 2016). A clear example of this is Prineville, a small village located in the vast countryside of the State of Oregon. Facebook and Apple both have large, important datacenters located at this site because of cheap power specialists (Representative of RISE ICT, personal communication, September 23th, 2016). But due to the absence of intellectual resources as labour, knowledge and innovative companies the region really struggles with attracting more datacenters and expanding the cluster (Representative of RISE ICT, personal communication, September 23th, 2016). This seems to be impossible because crucial elements are missing. In the case of Prineville this means that only lower rated jobs are fulfilled by inhabitants of Prineville, highly skilled personnel is flown from other cities. To a greater or lesser extent, this is an example of a cathedral in the desert.

Figure 5.5 Campus of Lulea University of Technology (Petrov)

From practice it turns out that good intellectual infrastructure in a concentration of datacenters is important for the long term. The presence of knowledge, labour and innovation ensures mobility between datacenters, brings new start-ups and spinoffs and let companies learn from each other (Representative County Administrative Board, personal communication, August 16th, 2016). The proximity of these amenities are important for the functioning of the whole cluster chain. Besides that, the presence of a good intellectual infrastructure is a more valuable product to use in attracting new datacenters. There are plenty places on earth that have lots of renewable power, good fibre connections and so on (Representative The Node Pole, personal communication, August 16th, 2016). However, the combination with university, research, innovation and suppliers is present in many fewer places.

5.5.3 Findings

In a well-functioning cluster, both physical and intellectual infrastructure are fully dependent on each other. This subchapter proves that physical infrastructure is key in attracting datacenters. Both areas subscribe the importance of having excellent physical infrastructure facilities, like power and fiber. At the moment Groningen is in a different development phase than The Node Pole, Groningen is actively acquiring and establishing new datacenters whilst The Node Pole already has a reasonable amount of

datacenters. This difference is reflected in the way respondents from both areas perceive the importance of physical and intellectual infrastructures. The fact that Groningen is trying to expand the datacenter concentration explains their strong focus on physical infrastructure. The Node Pole is a few steps further, they still recognize the importance of physical infrastructure but only as part of a larger whole. Intellectual infrastructure is for The Node Pole an important part of the whole because this adds new knowledge, innovation and labour to the cluster. Because these elements are derived from their own local economy, they can strengthen their position as place for datacenter industries more than only by promoting their physical infrastructure. This is an important lesson for Groningen which is currently too much focussed on physical elements, despite the fact that they have the ingredients for a successful intellectual infrastructure.

The foregoing leads to the conclusion that physical infrastructure is conditional for the arrival of datacenters, but both, physical and intellectual infrastructure, are needed for a well-embedded datacenter cluster.

5.6 Knowledge transfers

This subchapter discusses the extent to which Google's embeddedness is influenced by knowledge transfers between knowledge institutions and the datacenter. It is unlikely that Google's datacenter in Groningen will operate as a cathedral in the desert, without regional connections. However, the question is whether Google needs or wants connections with local educational institutions to foster their embeddedness. As seen in chapter 2, companies that act global are less willing to develop local connections, while if they do so, this possibly has a positive impact on the business development. The proposition in this subchapter is as follows: *the embeddedness of Google would not be enhanced by knowledge transfers between education institutions or knowledge-intensive companies and their datacenter.*

5.6.1 The importance of knowledge transfers for Google

During the interviews, most respondents were not convinced that Google would close strategic partnerships with knowledge institutions or educational institutions. Google is fully self-sufficient and thus not dependent on local knowledge infrastructures (Ex-representative of County Council Groningen, personal communication, May 23th, 2016). This is also due to the type of datacenter Google builds in Groningen, a co-location datacenter. Co-location datacenters are only meant for storage of data and are therefore less interesting for research and development. This will not mean that there will never arise local connections.

The University of Groningen is interested in connections with Google and sees concrete opportunities for new research (Representative University of Groningen, personal communication, May 26th, 2016). "There are already a number of professors who do relevant research that is very interesting for Google, they can use that knowledge in their own products" (Representative University of Groningen, personal communication, May 26th, 2016). Not only the university tries to work together with Google, HanzeHogeschool (higher vocational education) and two secondary vocational education institutions Alpha College and Noorderpoort already cooperate with Google. According to a representative of Eemsdelta EZ, Google requested a list of educational institutions with a special focus on secondary vocational education (personal communication, May 26th, 2016). This question from Google must be seen in the light of their needs for qualified employees. For running this type of datacenter successful, Google is more interested in vocational students than in master students or researchers (Representative of VNO-NCW MKB Nederland, personal communication, May 30th, 2016).

Although the interest in knowledge institutions in not immediately very large, it has to be said that Google is doing its best to be socially involved. Many companies try to follow the principles of Corporate Social Responsibility, Google also. But Google wants to make this concrete as possible, they see the importance to add value in the region in which they operate (Representative of VNO-NCW MKB Nederland, personal communication, May 30th, 2016; Representative Eemsdelta EZ, personal communication, May 26th, 2016). An example of this responsibility is their contribution to an education program for 25 elementary schools in northeast Groningen (Groningen Progameert, 2016). Another example is the Google Digital Workshop. A successful event for entrepreneurs, students and jobseekers with 1600 visitors in three days, organised in 2016 in Groningen. In 2017 a comprehensive follow-up will be conducted (Dagblad van het Noorden, 2017).

Respondents doubt whether Google is attracted by the proximity of Zernike Campus, see figure 5.6, and the strong IT cluster in Groningen city. According to a representative of University of Groningen, datacenters from Facebook, Apple or Google have extreme efficient design principles, invented in the USA and spread over the world (personal communication, May 26th, 2016). For colocation datacenters as Eemshaven, Google use their design from USA (only storage), once built it is actually sort of a data fabric which means research and development is not of vital importance (Representative University of Groningen, personal communication, May 26th, 2016). A representative of an IT network for entrepreneurs and companies in Groningen, SMC050, also doubt about the connection between Google and Zernike Campus: “I am not sure if they really have something concrete to offer each other” (personal communication, June 2nd, 2016). Another respondent, a representative from Groningen Seaport sees datacenters as only facilitating the whole IT process and therefore expects that research and innovation is not really important (Representative of Groningen SeaPorts, personal communication, May 30th, 2016).

Figure 5.6 One of the buildings at the Zernike Campus (Schipperheijn)

In a broader context, Google and the IT cluster are certainly relevant for each other. But to maximize the relevance it is very important that the NOM and Groningen Seaport attract more different types of datacenters (Representative University of Groningen, personal communication, May 26th, 2016). A representative of University of Groningen emphasized the importance of having different types, like the Google and e.g. Apple but also research or scientific data companies. The latter needs highly educated staff, researchers and the proximity of knowledge institutions more than colocation centers from Google or Apple. Research or scientific oriented datacenters are crucial in the functioning of a strong data cluster in Eemshaven because it creates new knowledge, attracts other companies and

could create start-ups and spinoffs (Representative University of Groningen, personal communication, 26th May 2016). The presence of such datacenters will also encourage Google to cooperate in projects.

5.6.2 Knowledge connections in The Node Pole

A few years ago The Node Pole was more or less in the same position as Groningen but has built an impressive knowledge position. When Facebook arrived in Lulea, there was only one professor at the Lulea University of Technology working on cloud services and datacenters. Today, thirteen professors investigate different subjects, all in the field of datacenters (Representative of RISE ICT, personal communication, September 23th, 2016). This growth is based on a strategy which takes into account the division of education levels in the sector. Because, just like Google in Eemshaven, the Facebook datacenter (and also other datacenters that arrived after Facebook) mainly offer lower educated jobs e.g. for the maintenance of systems within the center (Representative of RISE ICT, personal communication, September 23th, 2016). This type of work does not requires master degrees but the region recognized the importance of having professors, researchers and PhD candidates on different datacenter topics. Because, to grow an industry in a successful way, high educated people are needed to design and develop state of the art constructions and technologies or to help companies solving their issues (Representative of RISE ICT, personal communication, September 23th, 2016).

The rise of a knowledge structure in The Node Pole pays off: different datacenters are involved in projects with the university and even Facebook becomes more and more interested in research projects (Representative Lulea University of Technology, personal communication, August 25th, 2016; Representative County Administrative Board, personal communication, August 16th, 2016). This participation is remarkable because most of the datacenters have located their R&D elsewhere. The ongoing commitment to develop and apply knowledge is not limited to research.

Hydro66, a colocation datacenter in The Node Pole, used local knowledge to construct their wooden datacenter in the region (Representative The Node Pole, personal communication, August 16th, 2016). Hydro66 is a datacenter company that sees the benefits of being close to research, which is also visible in their promotion videos with the logos of knowledge institutions (Representative Lulea University of Technology, personal communication, August 25th, 2016). Foregoing examples prove that it makes sense to focus on knowledge development to strengthen a new industry, even if most of the requested employment potential is not directly highly educated. The Node Pole shows that a trickle-down effect generates new jobs through the whole chain.

5.6.3 Findings

The comparison between Google and The Node Pole shows again that both areas are facing the same discussions, either in the past or now. In both areas people (were) discuss(ing) the utility of strengthening knowledge structures and connect datacenters to knowledge institutions. Respondents from Groningen doubt because datacenters mainly need lower educated labour. The same reason as was heard in The Node Pole. Hence, the strong expansion of the amount professors made it possible to start cooperative research with companies. The fact that many companies are involved in projects with the university, despite the absence of the R&D department, is a significant signal. For Groningen this means that there are certainly opportunities to stimulate the CSR signals that Google now delivers. Given the organized activities in Groningen it is clear that Google tries to avoid becoming a cathedral in the desert. But the organised activities so far are one-way traffic which not really a strong example of embeddedness.

The Node Pole proves that it is possible to excite datacenter companies to participate in local research projects by which the place-firm relation is strengthened. This means that datacenters in The Node Pole better utilize the benefits of the community. The fact that Facebook, a company with a global

focus, intends to cooperate with local partners is quiet unique. The flexibility of The Node Pole shows that the concept of strategic coupling can be stimulated from the region itself to attract and seduce companies. This creates new local and global values for data companies.

Based on the case of The Node Pole it is clear that the embeddedness of Google can be enhanced by creating knowledge transfers between their company and local knowledge institutions. The participation from other companies can serve as a burden of proof for success to show Google it works.

5.7 Intellectual infrastructure versus the needs of a cluster

The previous subchapter showed that knowledge structures could play a role in the embeddedness of datacenters. The subsequent question, of course, relates to the available potential in Groningen to meet the needs of Google. Although it became clear Google will not start intensive cooperation until they are fully established, it is important to identify the most significant elements in the intellectual infrastructure. By doing so, the potential for strengthening the intellectual infrastructure becomes clear, even taking into account the desired expansion of the number of datacenters. This subchapter examines different parts of the intellectual infrastructure in Groningen, like demand and supply of labour, education institutions and network organisations, to assess the next proposition: The intellectual infrastructure of Groningen provides adequate facilities to answer the potential needs of a data cluster.

5.7.1 High quality infrastructure in Groningen

Considering the existing educational institutions in Groningen that offer courses aimed at the IT sector, it is clear that there is enough choice at every level of education. At intermediate vocational education level (MBO in Dutch) both Noorderpoort College and Alpha College offer a wide range of courses for jobs like network manager, ICT manager or application developer (Alpha College, 2017; Noorderpoort, 2017). At the higher vocational education level (HBO in Dutch) HanzeHogeschool offers an ICT course with more than 250 new students annually (Hanzehogeschool Groningen, 2017). University of Groningen offers a bachelor program Computing Science and subsequent three master, namely: Information science, Computer Science and Mathematics and Science Education and Communication (University of Groningen, 2017).

Besides the regular courses HanzeHogeschool and University of Groningen also have additional knowledge and research centers. HanzeHogeschool has a lectureship New Business and ICT which focusses on new applications for sectors like healthcare but they are also involved in the testing of 5G networks, together with companies (Hanzehogeschool, 2016). University of Groningen has a Center for Information Technology (CIT): “a leading national and European institute in the field of information technology” (University of Groningen, 2017). The CIT is currently launching an academic datacenter together with the Dutch Central Statistical Office (CBS in Dutch) (University of Groningen, 2017).

Furthermore, important institutions are located at Zernikeborg which is seen as IT exchange for the northern Netherlands. IBM is also seen as an important IT employer in Groningen city (Representative of VNO-NCW MKB Nederland, personal communication, May 30th, 2016). The concentration of this much IT related companies research and educations institutions already led to the rise of a community with 2300 IT professionals, called SMC050. (Representative SMC050, personal communication, June 2nd, 2016). This is a community in which meeting and discussing future challenges is central.

Although Google is expected to not participate in research projects in the short term, it is important to have an overview of the networks and knowledge and education institutions. Certainly, considering the expected arrival of several new datacenters (Representative Eemsdelta EZ, personal

communication, May 26th, 2016). The interviews have shown that many respondents from Groningen do not automatically connect Google and other potential new datacenters to the fairly large IT cluster. A representative of SMC050 doubts whether Google and the IT cluster can help each other because Google do not need innovators but network managers and maintenance staff (personal communication, June 2nd, 2016). For the short term, this is conceivable but to stimulate the development of a data cluster by attracting more datacenters, it is important to know the regional competencies. This helps in building local linkages between TNC"s and Groningen. According to a representative of the University of Groningen there is a lot of knowledge offered by education to business but this is to fragmented (personal communication, May 26th, 2016). So access to knowledge is good, only it needs to be more clearly organized in a platform. This could be a parallel with The Node Pole platform.

The availability of labour, another important part of intellectual infrastructure, seems to be no problem in the province of Groningen. It is to expect that the area can provide well-trained staff at different education levels (Representative of Energy Valley, personal communication, May 27th, 2016; Representative Eemsdelta EZ, personal communication, May 26th, 2016). The estimated ratio between the education levels is that 60% of the required staff should have an intermediate vocational education level, the remaining 40% concerns jobs at higher vocational education level (Representative Eemsdelta EZ, personal communication, May 26th, 2016; Representative of Groningen SeaPorts, personal communication, May 30th, 2016).

A representative of the University of Groningen expects an increasing growth in the attractiveness of the IT labour market in Groningen. The more (large and well-known) IT companies establish in Groningen, the more attractive it is to stay in Groningen after finishing a study (Representative University of Groningen, personal communication, May 26th, 2016). Hence, the wide range of studies is an important advantage for Groningen.

5.7.2 The Node Pole's intellectual needs

Students in The Node Pole have possibly less choice in different education levels than Groningen, hence, the University of Technology Lulea has benefitted optimally from the arrival of Facebook. The year after Facebook established, the university received 18% more registrations than usual (Representative County Administrative Board, personal communication, August 16th, 2016).

For the long run, respondents from The Node Pole underline the importance of a significant amount of local employees together with foreign employees (Representative of RISE ICT, personal communication, September 23th, 2016; Representative County Administrative Board, personal communication, August 16th, 2016). There are too few local employees, which cause competition between companies to recruit the best staff. This means, the industry needs graduated students to avoid too much competition. Recruiting local staff is seen as a reliable way of getting acquainted with the regional or national culture (Representative Lulea University of Technology, personal communication, August 25th, 2016). At the same time, a respondent from the County Administrative Board sees the influx of foreign employees as reinforcing the cluster because these people bring new knowledge into the cluster (personal communication, August 16th, 2016).

Figure 5.7 Students at the campus of Lulea University (Lulea University of Technology, 2017)

The Node Pole organization turns out to be functional to foster the quality of the intellectual infrastructure. The Node Pole Alliance is a successful element to which companies from the whole chain have connected themselves. Every specialism in the field of datacenters, from electricity to construction and technology, is represented by 80 regional, national or international companies in the Alliance (Representative The Node Pole, personal communication, August 16th, 2016; The Node Pole, 2017; Graf, 2015). The presence of this network ensures that newcomers can be provided with the right knowledge quickly and efficiently (Representative Lulea University of Technology, personal communication, August 25th, 2016; Graf, 2015). This is important for new data companies because it reduces their time to market by which they save money.

5.7.3 Findings

The presence of various IT courses at three levels of education, research institutions, and a large number of IT companies in Groningen provides a strong foundation to answer the potential needs of a data cluster. These facilities individually have useful knowledge for the datacenter industry. At the moment, knowledge about data is not concentrated in a platform or alliance but scattered about companies and research institutions or one on one relationships to them. Subchapter 5.4 already showed that intellectual infrastructure becomes more and more important over time, Groningen is insufficiently aware of this.

The Node Pole as organisation and alliance proves that a platform is a successful way to bring companies into contact, help new businesses and gain cluster benefits. In Groningen, the lectureship, CIT and SMC050 are valuable initiatives that can play an important role in bringing knowledge together and creating local linkages with Google or other large IT companies.

The supply of labour in the IT sector is expected to provide Google and potential datacenters with local employees. For this, the proximity of the sector related amenities and education institutions is an important advantage. The Node Pole showed that the supply of local labour is also a way to embed datacenters and make them familiar with the local culture.

Considering these results the proposition of this subchapter can be confirmed. With other words, the intellectual infrastructure of Groningen provides adequate facilities to answer the potential needs of a data cluster.

5.8 Regional awareness of the importance of embeddedness

The quality of physical and intellectual infrastructure can be good, but if the importance of an economic cluster is not recognized by governments and institutions, success can be left out. In Groningen quite a lot (semi) governmental organizations are concerned with developing economic policy or its implementation. It is important to know how these organizations perceive the arrival of Google and other potential datacenters because it affects the investment climate for new data companies in Groningen. The extent to which the data industry is valued by (semi) governmental organizations also influences the continuation or resolution of obstructive legislation and the time to market for new datacenters. This subchapter addresses the following proposition: Groningen recognises the importance of the embeddedness of Google and the construction of a data cluster.

5.8.1 Divided consciousness in Groningen

In Groningen different organizations have a role in economic development, attracting new companies or facilitating existing companies in their business operations. Normally, new companies have first contact with the Northern Development Organisation (NOM) from their role as acquirer. The NOM then contacts the necessary other agencies, usually the province of Groningen, Groningen SeaPorts and municipalities for locating a company in a suitable cluster area and organizing the necessary permits (Ex-representative of County Council Groningen, personal communication, May 23th, 2016). Both, the NOM and Groningen SeaPorts recognize datacenters as promising future cluster (Groningen Seaports, 2012). Even other organization noted the opportunities for the area as potential establishment location for datacenters, which means they actively try to attract this type of industry. The recognition of the potential of datacenters does not mean that the settlement process goes without saying.

The process of establishment, which consists of obtaining the right permits, has been delayed in a number of areas whereby Google felt insecure (Representative Province of Groningen, personal communication, May 26th, 2016). During the time in which licences and permissions needed to be organized, the Province appointed one person as contact person to make it as easy as possible for Google. Behind the scenes showed that processes were not interlinked. It is not the intention of this research to come into details of this topic. But the fact that most of the respondents state that the process has not gone well, gives reason to optimize the process for potential new datacenters (Representative of Groningen SeaPorts, personal communication, May 30th, 2016; Representative Eemsdelta EZ, personal communication, May 26th, 2016; Representative Province of Groningen, personal communication, May 26th, 2016).

In general, many parties appear to be convinced of the potential of a data cluster but none of the involved organisations takes the lead to connect the ambitions. Economic departments of municipalities, University of Groningen, Groningen SeaPorts, NOM, Province and the Economic Board Groningen all underline the importance of Google's establishment and expanding the data cluster in a broader context as important economic impulse. At the moment the NOM and Groningen SeaPorts have the most active role but this is strongly focused on acquiring new (data) companies, which is basically one of the core activities for both organisations. As stated in Chapter 2.2, the existence of strong, intertwined connections between regional stakeholders and TNC"s are important for a well embedded data cluster. The absence of this can adverse effect the embedding of Google.

5.8.2 Adaptability in The Node Pole

It may be clear that The Node Pole organisation exists to strengthen the local economy and the data cluster in Lulea and surroundings. Until recently, the organisation consisted of several public institutions as described in Chapter 4.2.2. The former organisation model proved that the region and

its public administration was aware of the opportunities that occurred after the establishment of Facebook. This does not mean that no complications have occurred during the establishment of Facebook (Representative of RISE ICT, personal communication, September 23th, 2016). During the granting of the right permits a lot of time is wasted by local municipalities. A representative of the Lulea University of Technology stated that: “the city of Lulea learned a lot from the Facebook case, because they have reorganized the whole organization, to be even more efficient and more fast, in order to meet the demands and do the right things when it comes to permissions” (personal communication, August 25th, 2016). The fact that the local public administration redesigned the process, shows the government is aware of the importance of time savings for large investors and wants to contribute to a fast set up.

The founding of The Node Pole organisation was a result of the establishment of Facebooks arrival in Lulea (Representative The Node Pole, personal communication, August 16th, 2016). Local stakeholders and governments expected that more datacenters would follow the decision of Facebook. This expectation is based on the rise of datacenter clusters in the USA and Ireland. To foster this snowball effect different regional partners in The Node Pole region recognized the importance to collaborate (Representative The Node Pole, personal communication, August 16th, 2016).

In order to avoid time wastage The Node Pole organisation has made an inventory of all available building blocks for datacenters. These potential blocks are all owned by the government, are provided with the correct zoning and can be quickly supplied with renewable energy, water and fiber (Representative The Node Pole, personal communication, August 16th, 2016. In this way, the government meets the wishes of the data sector to reduce the time to market after investment decisions.

5.8.3 Findings

Many different institutions in Groningen see opportunities that are related to the arrival of Google datacenter. However, in most cases, it remains in the recognition of the opportunities. Due to the lack of concrete projects or connections between regional parties and Google until now, Groningen leaves opportunities to anchor Google in their area. Building such links between regional actors, which are normally not direct related to Google, is based on the core of the embeddedness theory. The Node Pole organisation is again an example for Groningen that shows how regional stakeholders together can strengthen a cluster.

Acquisition of new datacenters is an important element among the different functions that come together in The Node Pole organisation. Groningen can more or less adopt the strategy on which building blocks are offered. This will decrease the time to market for new data companies significantly.

In general, organizations in Groningen recognize to a certain extent the importance of the embeddedness of Google and a potential data cluster. But the awareness is spread over many institutions and needs to be concentrated in order to concretize the embeddedness and anchor Google to Groningen.

5.9. Rules and regulations: tool or obstacle?

To get permission for the start of constructing a new datacenter, the plan must comply many rules and regulations. For foreign companies, the situation regarding legislation and regulations in the Netherlands is not always easy to understand. The various competencies and responsibilities between municipality, province and the national government do not contribute to this. When there is an overload of prohibitive legislation and regulations in an area this may hinder the arrival of more

datacenters and thereby the development of a cluster. This last subchapter of discusses the following proposition: rules and regulations are prohibitive for the embeddedness of (Google's) datacenters and a cluster.

5.9.1 Room for improvements in Groningen

First of all, it is an illusion that the settlement of a datacentre will go without any setbacks or failures. The acquisition of company, whatever the size is, will never be flawless (Representative of Groningen SeaPorts, personal communication, May 30th, 2016). The best an area can do is designing a framework in which it is easy for a data companies to settle their business in Groningen. This framework consists of an appropriate spatial development strategy (Structuurvisie in Dutch) and a correct zoning plan. Even if a datacenter fits in this framework, many permits have to be requested. These permits are mostly less time consuming than struggles with the spatial development strategy (Representative of municipality Eemsmond, personal communication, May 27th, 2016). Most important is the way in which involved actors handle with deficiencies.

The interviews showed that the delivery of the necessary permits by governments could have been faster and more efficient. At the same time, all relevant authorities have been committed to reduce the delay in the process. Again, it is not the goal of this thesis to evaluate the whole process of settlement but some lessons are important for the future. The main parts were not in order during Google's request, namely the spatial development strategy. In general, this has led to serious delay of time causing a lock on spatial economic development (Representative of municipality Eemsmond, personal communication, May 27th, 2016). Now, this is solved meaning that other new datacenters will not be hindered by the lack of a clear framework.

Figure 5.9 The datacenter site between the arable fields (Groningen SeaPorts, 2017)

This is not a guarantee that all procedures run efficiently. Different respondents stated that the Province has paid too much attention to the design of the building and the way in which this would fit into the landscape, see figure 5.9 for the location (Representative of Groningen SeaPorts, personal communication, May 30th, 2016; Ex-representative of County Council Groningen, personal communication, May 23th, 2016; Representative of municipality Eemsmond, personal communication, May 27th, 2016). This had a negative effect on Google because they became worried about the whole process of establishment (Representative of Province of Groningen, personal communication, May 26th, 2016; Representative of municipality Eemsmond, personal communication, May 27th, 2016). This is something the authorities in Groningen have to work on. It should be very clear for foreign companies which steps are necessary to establish.

The Dutch privacy legislation is seen by two respondents as a serious barrier for the arrival of other datacenters (Representative of Groningen SeaPorts, personal communication, May 30th, 2016; Representative of Eemsdelta EZ, personal communication, May 26th, 2016). The representative of Groningen SeaPorts stated that: "Google has found a way to anticipate to this, but with other acquisitions it is an important item". Privacy legislation is designed by the European Union but the Netherlands also has its own institution, Dutch Data Protection Authority (DPA), which apply stricter rules than the EU proposes (Representative of Eemsdelta EZ, personal communication, May 26th, 2016). One of the important issues in this is the fact that sensitive data is transported from the EU to America where it is saved and probably used by governmental institutions (Representative of Eemsdelta EZ, personal communication, May 26th, 2016). The area of Groningen cannot influence the privacy legislation but it is one of the many factors data companies consider before establishing.

5.9.2 Barriers in The Node Pole

Except in the field of energy, respondents from The Node Pole do not see much obstructive laws or regulations for the establishment of data companies (Representative County Administrative Board, personal communication, 16th August 2016; Representative The Node Pole, personal communication, 16th August 2016). Other Scandinavian countries have significant lower tax rates for energy. Sweden has special tax rates for certain types of industry, but datacenters are not covered by this. According to a respondent from The Node Pole organisation, the total costs of running a datacenter, consists of 60% of energy costs. This means that energy tax can greatly influence the choice for one or the other country. The Node Pole has been fighting several years to reduce energy taxes to be more competitive internationally.

Since January 1, 2017, Swedish tax rates for energy have been reduced with 97% for datacenters (Judge, 2016). A representative of The Node Pole stated that "this Parliamentary decision sends a clear message that Sweden is serious about becoming the green home of the internet and taking global cloud service leadership over the short and long term" (Judge, 2016). This decision, and the aforementioned (subchapter 5.8.2) change in the procedures of local authorities in The Node Pole area, proves that Swedish institutions are committed to eliminate barriers.

5.9.3 Findings

The government surely can affect the embeddedness of datacenters for the short and long term. This is the most important lesson from The Node Pole in this subchapter is. Lowering energy taxes is a good example of an anticipating government which sees the importance of an economic cluster. By doing this a cluster is more likely to stay for the long term because the place-firm relationship is improved. It is questionable whether the reduction of energy tax is feasible in the Netherlands because the datacenter industry seems to be smaller. But adjusting regulations can also be done in other policy field, to anchor the datacenter industry stronger.

Based on the Google case, the most prohibitive laws and legislations are in the field of the privacy and the design in relation to the landscaping. For Google this was not that importance that they decided not to settle, however, there was an uneasy feeling during the process of settlement. Other newcomers should be better supervised in the establishment process by giving better insight into the procedures. Groningen has also taken steps forward by renewing the spatial framework. From a realistic perspective, an establishment climate without barriers is for many sectors a dream. With respect to the possible improvements, there is no reason to believe that there are major barriers for datacenters in rules and regulations that hinder the embeddedness in Groningen.

Inside a Google datacenter (Google, 2016)

6. Conclusions and reflections

The last chapter of this thesis discusses the results. The research started with a central research question which can be answered after reviewing the results. But also the eight propositions deliver a contribution to the conclusions. After discussing the results, the second subchapter gives a few recommendations that arise from the conclusions. This chapter ends with reflections on this research.

6.1 Conclusions

This research is designed around the following central question: 'Which actions should local and regional actors in the Eemshaven undertake in order to create an attractive and sustainable climate for datacentres, in which local and regional offers come together with the needs of TNC datacentres? The answer to this question consists of the conclusions of the eight discussed propositions.

The first proposition stated that: 'the proximity of (green) energy plants exerts direct influence on the embeddedness of (Googles) datacenters'. Eemshaven has a unique position when it comes to power. The total amount of produced power by various sources, both non-renewable and renewable, ensures that it is an attractive place for companies which are very dependent on a reliable power supply with a high redundancy. However, almost al respondents agree on the importance of the proximity of power for datacenters, only two respondents from Groningen were sure about the relation between Google and the power plants. The renewable power solutions Groningen currently develops is key in attracting more datacenters because many TNC companies, like Google, want to reach sustainability goals. The Node Pole case confirmed that the proximity of renewable energy is almost indispensable in attracting new and embedding established datacenters but it is no longer a unique selling point because many regions have this facility.

The second proposition is also about physical infrastructure: 'the proximity of transnational, overseas data cables are of interest for the embeddedness'. This research confirms that availability of excellent fast and reliable fiber connections is very important for locating a datacenter. Respondents in Groningen are aware that the Tyco cable has been one of the reasons for Google to establish in Eemshaven. However, it appears that respondents recognise the relation between Google and the Tyco cable, more than they are certain about the role of the cable in the decision to establish. At the same time The Node Pole has a less favourable location when it comes to fiber connections but many datacenters have accepted this. This shows a decision to establish is always a combination of more elements that are of interest for a specific type of datacenter.

'The proximity of a city and, corresponding to that, good accessibility of the area has influence on the embeddedness of (Googles) datacenters'. This last proposition about physical infrastructure showed that the proximity of Groningen and Lulea near datacenters matters for an attractive establishment climate. Where power and fiber are conditional to settle, urban facilities, culture, housing and mobility modalities ensure long term attractiveness for expats and local employees. The importance of the closeness of a city and its facilities is explicitly confirmed by respondents from The Node Pole. Despite the presence of many amenities in Groningen, the awareness about the importance is not great.

The fourth proposition is as follows: 'for a well-embedded datacenter cluster, physical infrastructure is more important than intellectual infrastructure'. As seen in the aforementioned propositions the Eemshaven and Groningen have a strong position when it comes to physical infrastructure. In a well-functioning cluster is a dependency between physical and intellectual infrastructure. Both cases

emphasise the importance of physical infrastructure in attracting datacenters but in the long term, intellectual infrastructure becomes more and more important. The Node Pole shows that an expanding intellectual infrastructure strengthens the regional economy, it develops e.g. new knowledge and creates labour. Groningen is mainly focussed on physical infrastructure because they are in the phase of attracting datacenters.

The fifth proposition: 'the embeddedness of Google would not be enhanced by knowledge transfers between education institutions or knowledge-intensive companies and their datacenter'. A few years ago, in The Node Pole the same feeling prevailed as Groningen now, namely datacenters need mainly lower educated staff and acquires knowledge from elsewhere. But The Node Pole now proves that efforts to develop knowledge transfers have resulted in successful cooperation with datacenters, even when an R&D department of a company is located elsewhere. This strategy shows that a region can maximise the benefits for a cluster. Groningen has comparable amenities that should be utilized to build knowledge transfers with Google in order to create more dependencies for Google and foster embeddedness. Cooperative projects or other knowledge transfers contributes also to a climate in which companies feel involved.

The sixth proposition is the last about intellectual infrastructure: 'the intellectual infrastructure of Groningen provides adequate facilities to answer the potential needs of a data cluster'. The presence of many IT companies, research institutions and various IT courses at three levels of education together form a broad range of specialism which is able to answer potential needs of a datacluster. Groningen can easily achieve a lot of profit by connecting education institutions, research facilities and business networks to Google. The Node Pole showed that a concentration of knowledge in their alliance is a successful instrument to help new companies, create new knowledge and strengthen cluster benefits.

The seventh proposition is as follows: 'Groningen recognises the importance of the embeddedness of Google and the construction of a data cluster'. Many organisations and institutions in Groningen recognise the importance of Google's embeddedness and related to that the potential of datacluster in Eemshaven. This awareness is spread over the individual institutions without having a common sense of urgency to collect this challenge together. The Node Pole organisation shows that building links between regional actors and datacenters is important for cluster benefits. In order to attract datacenters in a successful way, help them embed and providing them in all their needs, it is useful to have a similar organisation.

The last proposition reads: 'rules and regulations are prohibitive for the embeddedness of (Googles) datacenter(s) and a cluster. This research showed that there are currently no major barriers in laws and legislations for datacenters but there are a some points of attention. The time to market must be shortened for datacenters which means the process of requesting and evaluating all necessary permits took too long. This was partly caused by stringent requirements regarding the design in relation to landscaping. It should be noted that all respondents responded to this from an indirect position. Datacenter companies themselves might have a different opinion on this subject.

The above conclusions and statements from the propositions extensive summarise the answer to the main question.

This chapter ends with a final answer to the main question. Groningen knows it has excellent establishment conditions for datacenters when it comes to physical infrastructure. Regional stakeholders should be aware of the importance of ongoing investments in physical infrastructure, in order to remain attractive. Concrete actions are investments in the amount of renewable energy, extending and improving the transatlantic cable packages to other continents and maintaining the supply of urban facilities. The most important lesson this research gives lies in the underestimated

importance of intellectual infrastructure. This needs serious attention when Groningen wants to develop a strong datacenter cluster. Cooperation between education, research and datacenters is an important action to facilitate this. Preferably this gets a position in a new cluster organisation like The Node Pole organisation. Such an organisation could also accompany newcomers through the process of requesting the needed permits, which can be seen as another action the region should work on.

6.2 Recommendations

- Renewable energy is no longer a unique selling point. Groningen should combine power benefits with e.g. regional intellectual capacities in their communication for datacenters.
- Groningen should focus on datacenters that need proximity to the backbone of internet. This type of datacenters benefits from strategic locations relative to costumers and fiber.
- The value of the city of Groningen is underestimated and should therefore be used more explicitly in the communication about Eemshaven.
- It is highly recommended that Groningen develops a strategy to take advantage of their intellectual infrastructure.
- In order to attract datacenters and serve established companies by helping them to embed and providing them in all their needs, Groningen should form a cluster organisation like The Node Pole. Such an organisation can commit to interests that serve the whole cluster: physical infrastructural investments, intellectual infrastructural improvements and attracting new companies.
- Newcomers in Eemshaven should be better supervised during the process of establishment.

6.3 Reflections

After conducting the research it is useful to reflect on the used literature, the methodology and the results. This helps to evaluate the process and learn from it for new projects.

The literature used contributed greatly to deepening the subject and the backgrounds. However, there is no excising theory about datacenter clusters, the used mix of theories offered a lot of effort. Most useful theories were ‘cathedral in the desert’, embeddedness theory and place-firm relationships. In retrospect, a clearer relation could have been established between the conceptual framework and the input from the used theories. Now the used theories delivered valuable insights but are not strongly and visible anchored in the conceptual framework. In the end, the principles of these theories are a red line through the research but under the surface.

Regarding the methodology, it may be discussed whether this method is most appropriate. For example a relational approach would have been a good alternative that could have mapped the relational linkages and the network between physical infrastructure, intellectual infrastructure and rules and regulations. But The Node Pole as an example for Eemshaven was perceived as a relevant development which could provide more concrete developmental points for Eemshaven. The way in which The Node Pole cluster is developed, conceals possible pitfalls for Groningen. A weak point is that no datacenter company is interviewed. Several datacenters are approached including Google itself, but none of the companies wanted to collaborate on an interview. Sometimes this made it difficult to understand specific business or establishment choices. The lesson learned from this is that it is also an option to contact more datacenters that are not necessarily located in the region. Another point about the interviews, respondents usually went into depth on a number of topics during the interviews. Especially with respondents from Groningen this was the case because the majority of them were

involved from a specific point of view. Because there were enough respondents from Groningen every topic had enough input. In The Node Pole this was more or less the opposite. There were less respondents, but they were all able to answer questions of the different topics.

Concerning the results, some of the conclusions can be seen as for granted, especially in the first part of the results about physical infrastructure. Nevertheless, these results contain useful details that are sometimes less obvious. Furthermore, some statements from respondents cannot be supported by others because they have not said anything about it. This might be seen as a weak point, despite the fact that some of those statements are confirmed later on through respondents from The Node Pole. Afterwards it would be better to take more interviews in The Node Pole. The four interviews that have been conducted gave a uniform image, but sometimes the triangulation is weak.

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