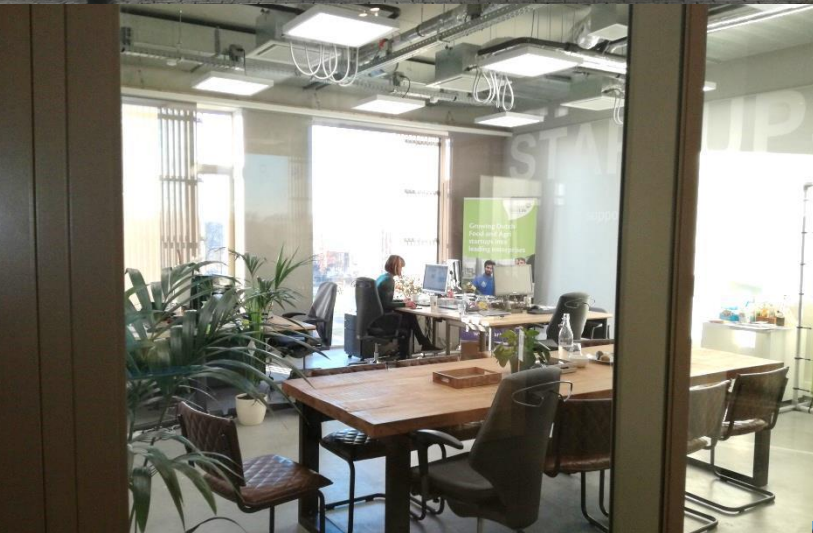# Location factors for Agro Food R&D start-ups, Wageningen UR campus study

Location factors for Agro Food R&D start-ups, Wageningen UR campus study
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This publication is written as a final master thesis report landscape architecture by order of the chairgroup of landscape architecture at Wageningen University.

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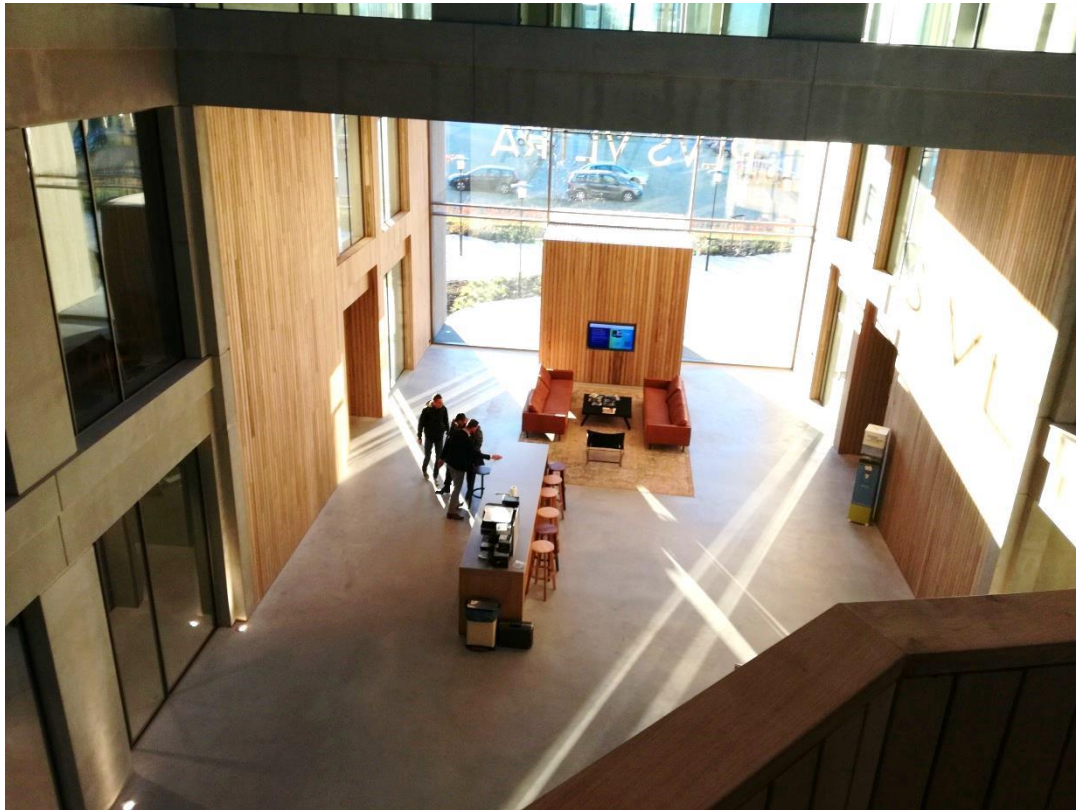
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Location factors for Agro Food R&D start-ups, Wageningen UR campus study

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Abstract

A knowledge gap exists regarding the importance of situating R&D start-ups near the campus. Nowadays the trend, known as campus development, slowly loses attention on political agendas. The campus is not only intended for research and education institutes anymore. Governments, policymakers and universities are eager to attract companies to their campuses. This thesis analyses whether R&D start-ups on and around the Wageningen UR campus prefer certain perceived production environment factors over others, and if: 'proximity of the campus' is of influence on these preferences. The results show that the vicinity of highly educated personnel and association with the knowledge core of the Wageningen UR campus is what R&D start-ups find important. Increased proximity to the campus does influence the valuation of location factors provided by the campus. Venture support and knowledge spillover is lacking on campus, especially 'on campus'. R&D start-ups face this issue. Limited use and access to these assets are not perceived as an obstacle for R&D start-ups around the campus, because R&D start-ups are able to find knowledge or facility assistance elsewhere.

Acknowledgement

Summary

The purpose of my thesis is to analyze whether R&D start-ups on-and around the Wageningen UR campus (Agro Food sector) prefer certain campus specific location actors over others, and if: 'proximity of the campus' is of influence on these preferences. The Wageningen UR campus is the only mature Agro Food campus in the Netherlands and therefore the case of this thesis. The reason for conducting this research is that it is not well known under which circumstances R&D start-ups in the Agro Food sector flourish. Besides the knowledge gap that exists in respect to the ideal production environmental conditions for R&D Agro Food start-ups; there also is a knowledge gap regarding the importance of situating R&D start-ups near the Wageningen UR campus. This is especially the case for the Dutch Agro Food sector, because it is a difficult branch for R&D start-ups to survive in and innovation stimulation for smaller companies in this sector is poorly researched. Therefore, the main aim is to investigate which location factors are the most important to R&D start-ups and to provide investors and policymakers relevant insights in possible suitable location choices and/or preferences for (upcoming) R&D start-ups. As such the research questions are: 1. what are the R&D start-ups characteristics and how can they be classified? 2. To what extent do the location factor preferences differ to R&D start-ups that are located on (1) / near (2) / or relatively far (3) from the campus?

This thesis has a qualitative research design. Two approaches for the qualitative research were applied in order to attain the data from the target groups. These two research methods are the use of 'written interviews' and 'face-to-face'. The face-to-face and written interviews contain the same questions, this means that the method 'qualitative research' is inherently overlapping in both approaches. Besides the qualitative interviews, a document analyze was conducted in which the content was both analyzed on by using codes and by summarizing the core message of the document. The interviews with the policymakers and larger companies support the data from the document analysis, which, together, support explaining of the results of the face-to-face and written interviews. These approaches, particularly given that this study focus on R&D start-ups, view the unruly situation of a R&D start-up as constructed in the intertwinement of disinformation and self-interest; it also values various ways in which disinformation arises, including less rational considerations. In total 243 R&D start-up companies received the written interviews, of which 48 companies replied. Besides the written interview, 12 semi-structured face-to-face interviews (of which 6 start-ups, 4 campuses and 2 larger companies) were conducted.

The thesis is composed of nine chapters, each of them dealing with different aspects of how R&D start-ups can be connected to the campus and, the other way around, the campus is connected to R&D start-ups. The R&D start-ups are divided on the basis of three proximity ranges from the Wageningen UR campus. On campus, the start-up incubation-and support counter 'Startlife' offers various programs and housing for 'young' R&D start-ups. Wageningen UR campus location can be classified as a Knowledge hub environment. Specific location factors typifying other campus archetypes (Creative Urban and Engineering hub) are included in the framework to investigate whether the current production environment fits with the location choice of R&D start-ups.

The results from this thesis show that R&D start-ups do not perceive a limited use-and access of these assets as a big obstacle, because, as they say, 'they can find this knowledge or facility assistance, elsewhere, outside the region' (like venture support for business development or lab uses). Most of the face-to-face R&D start-ups indirectly refer to the image of Wageningen UR campus being one of the most mentioned connectors to the campus, above the other investigated location factors of the analytical framework.

From the thesis results it is suggested to build on the core qualities (image and presence of highly educated personnel) of the campus. This means that 'presence of knowledge' related aspects in

regard to image creation towards the (international) market should improve. Besides, improving quality of current meeting and interaction spots and finding additional focus and attraction of international stakeholders are important in regard to improving the international image of Wageningen UR campus. Let stakeholders (graduates, students) on campus interact with the R&D start-ups. Enable low-key interaction and make these interactions flexible and affordable.

Key words: campus, production environment, location factors, R&D start-ups, cluster, agglomeration

Table of content

1.   Introduction

Wageningen University, before it was known by its current name, was founded in 1918, formerly known as 'the National Agriculture University'. After the Second World War, the Dreijen campus, located between Ritzemabosweg and General Folkesweg, experienced a large growth in student numbers. The Dreijen complex was eventually completed in the 90s. Since the year 2000, plans were laid out to build a new campus far to the north side of Wageningen city (along the Mansholtlaan to Ede) (Kadans, 2015). The Wageningen University & Research centre (Wageningen UR) campus is a terrain on the north side of Wageningen that exists of a Dutch University and a number of commercial companies. The Mansholtlaan connects the campus to the nearby the highway A12. This highway is the main entrance route for reaching the campus. Besides the name change of the university in 1998 to 'Wageningen UR', its policy and strategy changed with it. The campus terrain (The Born) at the north side of the city became the center for educational and research activities. Around the campus and on the nearby industrial zone (Agro Business Park), medium-and smaller sized companies, start-ups and experimental fields occupy the outskirts around the campus (Haar, 1993). Nowadays Wageningen has more than 40.000 inhabitants and a total of 33 km^2 of land area in 2012 the University counted 7933 students of which approximately 2000 students were foreign students. These students consisted of 106 nationalities ranging from Ethiopia, Greece, Germany to China. This makes the campus and the city an intercultural hub and raises notion towards a diversity of cultures and issues in communication (ARCHIEVEN. 2014; UR, 2012). More information about Wageningen UR and the campus is elaborated in chapter 3.1 'Case: Wageningen UR campus'.

1.1 Context

In the past, campus development was focused on serving the academic living environment. Nowadays, it is viewed as a breeding ground for innovation. In recent years, the demand for knowledge in the business sector has risen significantly. Due to this rise in knowledge demand, iconic R&D companies have recently settled on and around the campus; the trend has begun (Dijkhuizen et al., 2002). Campus development is becoming increasingly popular among policymakers in the Netherlands as well. This increase in popularity is partly driven by the idea that a campus environment stimulates innovation and thus increases long-term profits for all parties involved. A connection between the business and academic sector is therefore essential. The most promising, distinctive and surprising innovations emerge from smaller companies (Ministerie van EL&I, 2011). At the same time, the attention and focus reserved for these smaller companies remain relatively marginal (Ministerie van EL&I, 2011).

R&D start-ups are the focus group of this research. Smaller companies, like R&D start-ups, make up for the largest number of companies within an economy, but literature about open innovation remains fairly' under-researched' among smaller companies. R&D start-ups have the potential to become a small 'independent' company and can grow up to even larger proportions (Van Oort, 2007).

This paper focuses on acquiring insights about R&D start-ups, their locational preferences and perceived benefits of campus development in regard to their production environment (campus). Besides the start-up's location factors and production environment, this paper seeks to give insights in whether different geographical proximities relative to the campus (combination with R&D start-ups characteristics) influences the R&D start-up's perceived benefits of the campus.

Open innovation, among other motives, is embedded into the idea of shaping and expanding campuses in the Netherlands. Open innovation, as one of the campus's properties, is concerned with cooperation, beyond the campus's boundaries.

Knowledge transfer, business development, knowledge valorization, networking and corporate acquisition are other matters besides cooperation needed for realizing open-innovation. This paper will not address any of the previously mentioned concerns of open innovation, though it is important to keep these driving forces behind open innovation, and thus campus development, in mind (Dijkhuizen et al., 2002).

In order to solve the previously mentioned problems regarding the perceived benefits of localizing start-ups near the campus, a set of research questions is presented in chapter 1.3: 'Research objective' and 1.4 'research questions'.

1.2 Problem description and statement

1.2.1 Problem description

This section describes the problems that drive innovation and thus campus development, and why it is unclear where R&D start-ups should be located regarding their location preferences and generic characteristics. Chapter 1.2.2 'problem statement' section provides an overview of the problems treated in the section of chapter 1.2.1; 'Problem description. The core problems, are the specific problems that this research will give more insights in. The underlying problems are foundations of the core problems regarding this case

Core problems

The Agro-Food sector is a difficult branch to start a company (Dijkhuizen et al., 2002). Besides the difficulty to start a company in this sector, it also is not known under which circumstances start-ups flourish. The functioning and economic returns of innovation have proven to be profitable in the long, but whether the same principle of innovative stimulation accounts for campus development and start-ups is poorly researched. As the article of Oort states: "…The knowledge exchange between universities and companies and also between scientists and researchers is scarce, the exchange is very path dependent…" (Oort, 2014, p 38). Do R&D start-up companies actually utilize the potential promised benefits of the campus and does the campus benefit from the R&D start-ups?

Starting companies in the R&D agro-food sector require valuable necessary initial investments. High initial investments are required in all business activities of the start-up. The extent of which these start-ups depend on proximity to facilities or external equipment varies per start-up. The campus, in this case, could provide these necessities, but maybe other location factors like; image, scaling benefits or practicality are at play (Initiatiefgroep FoodValley ambition 2020, 2009). In other words; it is generally unknown which location factors and production environments are most appreciated by start-ups located on different geographical distances and how this relates to the type of start-up.

Underlying problems

In recent years, governments have focused too much on cluster organizations before thinking about the content. Organizations should think about: 'How projects could be established and which facilities are needed to realize this'. For instance, government's operations in the Twente region case state that execution of policy visions is a different task than the operationalization of policies. 'A gap exists between the capacity to operate and the vision of the region itself', this gap is inadequately filled. Another problem with clusters is that the cluster is often seen as the goal itself, while long-term vision is neglected. Again, it is a big question as to how the spatial environment has to shape in order to incorporate long-term developments (Oort, 2014).

Besides problems emerging from collaboration and innovation, this paragraph shortly summarizes a few major issues start-up companies are commonly subjected to.

Institutional entrepreneurs may fail or succeed due to (in)adequate localizing, mobilizing or reserving competencies and influences of intangible/ immaterial resources (Dijkhuizen et al., 2002). This question arose mainly because small clusters are more dependent on smaller companies than the existing clusters.

An important environmental factor for start-ups is the presence of a well-developed financial market. Initiating the basic foundations for setting up a start-up, requires a substantial amount of external financing in order to realize the start-up (Dijkhuizen et al., 2002). The procedure of beginning a start-up does not end when the start-up's basics are set, besides fixed investments start-ups have to compensate for continual costs. The reason why the required investments often are insufficient is because unexpected costs often exceed its initial budget. Exceeding the budget requires continues injections of financial capital. Besides continues investments, banks are not always in the right position to estimate the chance of success (Atzema, 2008). Additionally, banks have the tendency to act risk-averse; resulting in safe, short-term, 'return of investments' –based actions. Luckily for start-up companies, venture capital, mentioned by the name of "businesses angels", focuses on assisting and enhancing the chances of success besides providing the required funding. The previously mentioned 'Startlife' project in Wageningen UR campus is one of these public initiatives, which serves similar purposes. These capital ventures are capable of estimating success rates through skills and experiences in strategic, financial and risk-management (FoodValley, 2014)

In conclusion to this short paragraph about problems faced by start-ups, the integration of knowledge in the business sector is important in feeding the Dutch knowledge economy. Or as Bill Gates once stated: "The problem in Europe is not the lack of knowledge, it's the lack of knowledge-based companies." (Van Looy et al., 2001, p. 182). Also, existing clusters are set up by large corporates that have had their share of governing experiences in the past. Through spin-off initiatives, these start-up companies receive proper guidance and funding, but the link with the campus may still be missing. Independent start-ups lack both the guidance/funding and the link with the campus. This means that start-ups require proper guidance on how to function along a campus (Ebbekink, 2015).

Recent news reports regarding campus development state that; there is too little attention for cross-overs (i.e. knowledge spillovers) in top sector policy (Ministerie van EL&I, 2011). Campus development seems to draw this attention away from starters, and the regional top sector policy boards decided to focus on campuses alone mainly hoping to increase global and national market power top sectors (Ministerie van EL&I, 2011). The ministry of EL&I describes campuses as an important element in the contribution to top sectors. Investments within one region are not only bound and beneficial to one specific top sector. On the contrary; the investments and their benefits will also influence other top sectors, therefore influences from different sectors require collaboration between those sectors (note: Eindhoven Brainport case). The benefits to the top sector may not always benefit all company layers within that sector (smaller companies). Dispersion of knowledge is an important factor in the emergence of innovation; innovation is needed; so a competitive knowledge economy can be realized (Gertler, 2003). It is still unclear to what extent companies will benefit from campus-related innovative processes, agglomeration or what made a company successful, as being part of the campus, in the first place (Atzema, 2008).

Large companies play an important role when it comes to spin-offs, they decide which activities may continue and how the spin-offs can aid the company by adding value. The stimulation of spin-offs between related sectors might be beneficial for the incorporation of smaller companies in general. The problem is the role of spin-offs regarding the link between the remaining business sector is fairly under-researched (Van Groenigen, 2013).

'Start-ups are generally more influenced by policy', as stated by Raspe & Van Oort (2007). The article of Van Groenigen has investigated smaller companies and asked them about their perception of the innovation power of campuses on their business and sector. Knowledge does not reach the

businesses quick enough, companies reply (Van Groenigen, 2013). This infant knowledge, gained from small companies, can be used to create a new system and develop innovative products that benefit the whole of society. Smaller companies are especially depending on fast and affordable knowledge transfer. The article of Van Groenigen, 2013 concluded that the role of location choice might have an impact on required interactions between start-ups and business sector (van Groenigen, 2013). Policy can play a role regarding this matter; it could reinforce organizations that could facilitate these cross-overs while simplifying and speeding up the process (Raspe & Van Oort, 2007).

The role of smaller companies in the 'Chemelot campus case article' is argued. The article of Van Groenigen, 2013 concluded; the top sector is simply unaware of the activities surrounding the campus. The top sector does not take inventory often enough and lacks understanding about the processes and operations of smaller companies. Larger companies are better represented within top sector policy (Van Groenigen, 2013). Camelot and DSM are good examples of this. Smaller companies can be very diverse and not always well-organized like large, more well-established companies are. Even the province of Limburg, for that sense, has the feeling that the smaller companies are barely involved (Keeris, 2012). The focus should shift from large corporations who are already doing well to finding ways to connect the smaller companies to the sector. Policy makers should not be concerned about the survival of large corporations because they know their way around; instead, they should be concerned with the smaller ones. The province can co-finance campus development, but it is worried that certain issues regarding budget distribution may prevent the co-financing from happening. It is difficult to convince government officials to invest in non-provincial matters due to different interests and uncertainty. Therefore, the exact role of regional parties in incorporating smaller companies is still uncertain and needs further research (Ministerie van EL&I, 2011).

Another finding of Keeris, 2012 is that smaller companies are not as societally involved as policymakers thought they would be. Generally, this is seen as a big problem because there is, yet, no clear solution for involving those smaller companies. Smaller companies differ greatly from one-and-other. This also makes it hard for policymakers to treat a heterogeneous group of R&D start-ups in a standardized way. Top sectors are currently looking for different methods for attracting, involving and incorporating start-ups and spin-offs (Keeris, 2012, Groenigen, 2013). Smaller companies are putting their time and effort in running their business, and only have little time to join meetings or deal with policies (Raspe & Van Oort, 2007).

1.2.2 Problem statement

Statement

The lack of knowledge about the conditions in which R&D start-ups flourish coincide with uncertainty about probable suitable locations for the starters who are under the influence of location factors that impact their production environment and therefore the internal functioning of R&D start-ups.

Core problems

To put the problem in a short and concise problem statement, the previous mentioned problems are summarized:

- It is not known under which circumstances R&D start-ups flourish.
- It is unknown which location factors and production environments are most appreciated by R&D start-ups located on different geographical distances and how this relates to the type of R&D start-up.
- There is a knowledge gap regarding the importance of situating R&D start-ups near the campus.

1.3 Research objective

Scientific objective

The scientific objective is to find out which location factors are most important to the start-ups. Location factors are factors of the environment that ensure continues functioning and growth of the company (Ebbekink, 2015). R&D start-ups on and around the Wageningen UR campus prefer certain perceived production environment factors over others. Another objective is to discover whether 'proximity of the campus' is of influence on these preferences (Ebbekink, 2015; Van Groenigen, 2013).

The production environment entails all external circumstances that can be of influence on the location, where the company is situated, and how this influences the company's functioning right after the moment of settling (Keeris, 2012; Van Groenigen, 2013; Raspe & Van Oort, 2007).

Societal objective

The societal objective is to provide investors and policymakers relevant insights in possible suitable location choices and/or preferences for (upcoming) R&D start-ups. The case's focus is the Agro-Food sector and the Wageningen UR campus as its knowledge core in specific.

1.4 Research questions

Main research question

Does the proximity to the campus influence the location choice of R&D start-ups?

Specific research questions:

1.   What are the R&D start-ups characteristics and how can they be classified?

2.   To what extent do the location factor preferences differ to R&D start-ups that are located on (1) / near (2) / or relatively far (3) from the campus?

1.5 Report structure

Chapter 2 introduces and connects various concept leading up to the analytical framework. This chapter also explains the framework and how it connects with concepts and research questions. Chapter 3 elaborates on the approach. Within this chapter, various methods (face-to-face & written interviews and document analyze) are explained and how these methods support triangulation of the study. Chapter 4 contains the results of the study. Each of the location factors are structurally treated with regard to the three methods used. Chapter 5 answers the central problem statement and compares consequences in regard to the problem statement, scientific objective and the results. Besides answering the central problem statement, this chapter contains recommendations for future research and policy. Chapter 6 contains the discussion in which the results are interpreted according to the analytical framework.

2. Theoretical background

2.1 R&D Start-ups in a campus environment

This section introduces a range of theories, views and perspectives that assist in developing the theoretical framework, introduced in chapter 2.2. The subchapter is chapter 2.1 shows how the various concepts are dissected from the campus to the individual R&D start-up level. The framework in chapter 2.2 contains directions of the various aspects and sets boundaries to the theories.

2.1.1 Start-ups: a definition

There is no exact definition of a start-up, though in literature a wide range of definitions exists. Van Auken and Neeley, 1996 describes historical developments of definitions of small business dating back from the nineteenth century to present day (Van Auken and Neeley, 1996). The article emphasizes that the definition of a small business has changed over time. Variables about what a small business entails include: annual sales, the number of employees, management structure, industry dominance and a number of assets. The article of Auken and Neeley, 1996 states: "A small business is defined as a firm (1) that does not have existing publicly traded common stock and (2) in which planned financing must be personally guaranteed by the owners." (Auken and Neeley, 1996, p. 237). According to Neil Blumenthal, co-founder and co-CEO of Warby Parker: 'A start-up is a company founded to solve a specific problem, while success is not guaranteed nor obvious' (Korunka et al., 2003) In short; a start-up is a company that clings to a new idea and plays with 'putting this idea in economic context', so a new profitable, feasible and scalable products or services can emerge (Korunka et al., 2003). This new product or service is accomplished through combinations of new technologies and existing products or services. Repeatability and scalability of the product entail that the product blueprint can be made once, and from that moment on; can be reproduced and sold in numerous quantities (Korunka et al., 2003).

In contrary to normal start-ups, spin-offs originated from a mother company (i.e. knowledge institute or larger companies). These spin-offs have direct access to resources and funding from these mother companies. The mother company can ensure quick growth and a solid start for the individual spin-off company. Besides the quick start and solid growth, the mother company can increase the probability of success and survival once the terms of collaboration between the spin-off and the mother company are agreed to by both parties. The mother company can provide access and supply of physical and non-physical resources, share previously acquired knowledge-and-skills and financial support to the spin-off. The non-physical resources that are important for the spinoff are; licenses, patents, and (social) networks. Through pre-established connections between the mother company and the spin-off, the spin-off is more likely to develop collaborations or mutual projects between financiers and/or clients (Pouder and John, 1996). **2.1.2 Characteristics of R&D start-ups**

Start-up classification

Mustar et al., 2006 has done research about various articles and made an overview of categorizations for spin-off companies. Spin-off companies are basically start-up companies that are one-way-or-another supported by a third party (Robson and Bennett, 2000). Some articles use the term R&D start-ups (Freeman & Engel, 2007), others refer to spin-offs (Wetering, 2006) and most articles merely use the term 'companies' (e.g. Atzema, 2008). The article of Mustar, et al., 2006 addresses the issues of importance of understanding heterogeneity of R&D start-ups (Mustar et al., 2006). This research addresses three dimensions on the basis of variations between start-ups. These dimensions are; institutional links, business model and the types of resources. The typology of are divided into two groups; start-up creation (1) and start-up development (2). Table 4 provides a matrix of the various articles written about start-up categorization (Mustar et al., 2006).

		Institutional Link	Business model	Resources				
				Sources of resources	Technical resources	Human resources	Financial resources	Social resources
Institutional Link		Steffensen et al (2000) Autio (1997)	Pirnay et al (2003) Mustar (2002)	Carayannis et al (1998)		Fontes (2001)		Nicolaou and Birley (2003)
						Heirman and Clarysse (2004) Hindle and Yencken (2004)		
Business model			Stankiewicz (1994) Scholten et al (2001)	Clarysse et al (2003)	Fontes (2005)	Upstill and Symington (2002)		
						Druihle and Garnsey (2004)		
Resources	Sources of resources						Wright et al (2004)	
	Technical resources				Autio and Lumme (1998)			
	Human resources					Franklin et al (2001) Radosevich (1995)		
	Financial resources							Shane and Stuart (2002) Mustar (1997)
	Social resources							

Table 4: Mustar's Classification matrix, providing an overview of the institutional link, business model, resources of start-up/spinoff companies (Mustar et al., 2006).

R&D start-up characteristics

The table 5 below provides an analytical overview of firm's characteristics that are be used to classify the various start-ups across the sectors. The firm's classification, presented in table 5 will form the basis for classifying the various start-ups in the written interviews. The firm's stage and drivers describe the stage in which the firm is functioning (Robson and Bennett, 2000; Chan and Lau, 2005). Each stage within the company requires a different need for resources. The driving forces in developing the company may tell the observer the start-up's future ambitions. So a company that is content with the current situation, in which the company functions, will not try so hard to find new employees for its company. The 'Firm's independence' is regarded to the extent in which the firm is connected, depending or working in the interest of third parties. This aspect is important to take into account because this will impact the firm's budget, focus and therefore their needs. Besides a different set of needs, they might be less dependent on 'external connections', because they already have reliable connections that contribute to their momentary success. External connections that are connections not already embedded within the status quo network of the firm (Robson and Bennett, 2000; Chan and Lau, 2005). Another aspect of the firm is what 'type of innovator' they are. The article of Clarysse et al, 2005 well describes the two variables that determine the type of innovator

the firm can be, as is shown in table 5. These two variables are 'novelty of market' and 'novelty of technology'(Clarysse et al., 2005). The novelty of market determines whether the firm is competing within an established or emerging market, while the novelty of the technology determines whether the firm's technology is established or a breakthrough in natural science. The type of innovator is a distinctive aspect of the firm, which is useful in distinguishing the various start-ups because they show the generic make-up of start-ups within the sector (Felsenstein, 1994). So, for instance; business segments that are mainly focusing on paradigm innovation may be less interested in knowledge exchange with other knowledge institutes than application innovators that have waterproof or better-established IP protection. Unexplored markets and technologies tend to 'stand on thin ice' when it comes to legislative protection of intellectual property. The reason why these firms stand on 'thin ice' is because they are often embroiled in legislative 'grey fields' (Clarysse et al, 2005; Raspe, et al., 2004). Appendix 1 shows other classification factors that could be used to classify a start-up. Chapter 3 'methods' explains why these classification factors have been chosen to interpret the data

Firm's stage and drivers (Robson and Bennett, 2000)(Chan and Lau, 2005)	Firm's independency (Clarysse et al., 2005).	Firm's type of innovator (Clarysse et al., 2005).	Firm's economic situation (Di Gregorio and Shane, 2003)	Firm's focus (Clarysse et al., 2005).
Stage of growth (moment of success): Set-up, settle down& product development, start marketing, start selling (Robson and Bennett, 2000), (Chan and Lau, 2005)	Intensity of university connection (Felsenstein, 1994)	(Relatively) new market or existing market & established technology and breakthrough technology (Clarysse et al., 2005; Di Gregorio and Shane, 2003)	Location of market (local or otherwise) (Di Gregorio and Shane, 2003; Laursen & Salter, 2004)	Types: process based (facilitating processes in production), product-based (developing (parts of) end product), service-based (consultant) (Clarysse et al., 2005; Wright et. al., 2004).

Table 5: characteristics for R&D start-ups based on Mustar's Classification matrix (see table 4) .

The question is: 'what do the different characteristics of R&D start-ups tell about their connection to the campus environment?' First of all, in regard to any taxonomic makeup of an R&D start-up for that matter, the article of Laursen & Salter, 2004 states that the R&D start-ups' business strategy (which is intrinsically holistic) is the main driver in the intensity to which the start-ups utilizes the university's resources. Or as the article states: "The interactions between universities and industrial firms remain largely indirect, subtle and complex" (Laursen & Salter, 2004, p. 12). Despite the complex nature of the connection, the following paragraph, one-by-one, treats each of the previously mentioned R&D characteristics and their implication on their role in utilizing the campus/university. The following paragraph aims to shed more light on the complex nature of the connection between R&D start-up characteristics and the utilization of the campus.

The first characteristic is about: when the R&D start-up started. As a venture investor, it is generally risky to invest in new R&D start-ups, because the business has not yet proven its viability for long-term returns (Raspe, et al., 2004).
The second characteristic is about using the 'incubation program itself'. The quality of staff that provides the incubation program is detrimental to the entrepreneurial output of the R&D start-up. If the staff is more focused on breakthrough discoveries instead of commercialization, this greatly influences the R&D start-ups success (Wright et. al., 2004). In regard to the third characteristic 'type of company', university spin-offs exploit technological knowledge more than any other R&D start-up (Chesbrough et. al., 2006). When looking at to the fourth characteristic 'use of technology', R&D start-ups which exploit basic scientific discoveries (often not interesting commercially/societally), lack to attract venture investors (Di Gregorio, et. al., 2003). These basic new scientific discoveries

influence the fifth characteristic 'market and technology' used by the R&D start-up, by stimulating R&D start-up activity mainly in old markets and using established technologies, or as the article of Laursen & Salter, 2004 puts it: 'conventional knowledge sources are prime drivers in R&D start-up innovation activities' (Di Gregorio and Shane, 2003; Laursen & Salter, 2004). For the sixth characteristic 'stage of development' the article of Di Gregorio, et. al., 2003 states that private venture investors often invest in more established start-ups, therefore making 'on campus' R&D start-ups more dependent on government funding provided by the university (Di Gregorio, et. al., 2003). On the other hand, the finding of the article of Laursen & Salter, 2004, which mentions that R&D start-ups that are in a later stage of development can produce more R&D output and therefore have the propensity to use more of the university's resources (Laursen & Salter, 2004). This finding, combined with the statement of Di Gregorio, et. al., 2003 implies that privately funded R&D start-ups have a higher chance of using university provided facilities (which is, for the most part, funded publicly). The seventh characteristic is 'connection with the university'. The nature of the connection between the R&D start-ups and the university is prone to the dynamic capabilities within the R&D start-up and that R&D start-ups located on campus have a low level of interaction (barely a connection) with the university but that it is still a better connection than that between university and R&D start-ups located further away (Wright et. al., 2004). The eighth characteristic is the 'focus of the company'. The article of (Wright et. al., 2004) mentions that production based (concrete product opportunity) are typically financed with debt instead of venture capital and have difficulty attracting professional management (Wright et. al., 2004). The final, ninth characteristic is the 'market location'. The article of Clarysse et al, 2005 mentions that in the context of globalization, small R&D start-ups must compete with international (not just local) firms to supply the large local companies (Clarysse et al, 2005).

2.1.3 Campus: a definition and its function

The first campuses, or commonly referred to as science parks, were realized in the early 90's in the Netherlands. These campuses were developed to accustom a, in that time, refreshing form of industrial politics. Nowadays the trend, known as campus development, is slowly losing attention on political agendas (Buck Consultants International, 2014). The campus concept in the Netherlands is not merely destined to function solely for research-and-education institutes anymore but has seen to take many forms (IMBO, 2014).

In literature, multiple definitions of a campus exist. A science park is "…a planned development of high technology enterprises in an attractive physical environment with close links to a university…" (Matthias, 1986, p. 116). Or as a high-value location that provides an opportunity for knowledge intensive ventures and shared facilities (BCI & SRE). And thirdly "A location that contains a knowledge carrier like a university, R&D center, large international company, research institute or academy" (BCI & SRE; Baptista and Mendonça, 2010, p. 67). For better understanding, within this thesis, the term 'campus' is used instead of a 'science park', because both terms serve a similar meaning throughout literature.

The variation of actors on a campus promises to accelerate success and boost the ecosystem's robustness, though empirical evidence is lacking (Pouder and John, 1996; Bok, 2009; Torre, 2008). Besides education purposes, the goal of the campus is to provide a suitable climate for economic developments and hatching opportunities for intriguing and inspiring innovations (Autant-Bernard, 2001). These institutes and people are often active within a similar sector. Here, a high density of people is expected to facilitate networks of companies and people that exchange knowledge (Griffith, 1994).

These days, developing the campus is not only a task reserved for educational and research institutes alone. According to the article of IMBO 2014, in general, all spatial projects requiring the cooperation of research entities, business life, and the government can be defined as a campus (IMBO, 2014). This makes defining what a campus is, sensitive to interpretation (IMBO, 2014). The appearance, content focus and scaling among campuses can vary widely (Banja et. al., 1993). This can range from a former school building, like on the south-side of Amsterdam called 'old-school' to a multiple hectare areas in Eindhoven; called the 'high-tech campus (Brainport) Eindhoven'. More often; existing areas or building complexes are chosen for campus development than the construction of new building complexes, otherwise known as: 'greenfield development'. Also, more often in campus development, the link between living, working and facilitating is made; meaning that the campus wants as much diversity on its territory as possible (IMBO, 2014; Bok, 2009). The substantive focus, scaling, and proportions of a campus vary widely as campus development includes both young and old companies.

A campus can therefore have the same properties of a cluster which, according to the article of Porter, 2000 a cluster is "…a geographic concentration of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standards agencies, trade associations) in a particular field that compete but also cooperate." (Porter, 2000, p 24.). The cluster concept, like the campus concept, therefore also is sensitive to interpretation. Although there is not an exact definition of a cluster nor a campus (IMBO, 2014), the definition of a campus defined by Vedovello, 1997 is similar to the definition of cluster defined by Porter, 2000. The article of Porter, 2000, which is a geographical concentration of certain location factors, see section '2.4: Aspects of the Knowledge hub' (Porter, 2000). The campus brings institutes and people, which conduct similar activities, together (Vedovello, 1997). The difference between both concepts is that the campus concept serves 'an action' which is: 'bringing people together' and the cluster concepts states what is present within an area: 'certain location factors', see section '2.4: Aspects of the Knowledge hub' for the precise definition of Porter, 2000. In conclusion: combining both the cluster and campus concept of Vedovello, 1997 and Porter, 2000 then defines the campus as a cluster as: 'An area which contains certain location factors that bring people together'. Since the cluster and campus concepts of the article of Vedovello, 1997 and Porter, 2000 are not mutually exclusive, throughout this thesis, aspects of a cluster which are: 'location factors', are used to define the campus as such.

Once the knowledge reaches the 'right' entities, it can accelerate knowledge production. Campuses are depicted as knowledge breeding grounds which deliver the knowledge to the companies that market that knowledge through innovative ideas and products. The production of this knowledge, in the end, is expected to lead to regional prosperity and economic success of the companies (IMBO, 2014). Atzema (2008) states; that the presence of knowledge, besides the various facilities, are an essential motive for companies to settle on or near a campus. In addition, the article of IMBO, 2014 states that; proximity of universities or knowledge intensive institutes to other companies can assist those companies in transforming knowledge into economically interesting products or services (also known to be called: 'valorization') (IMBO, 2014).

Governments, policymakers, and universities are eager to apply these successful mechanisms to their own region (Atzema, 2008). The focus of campus can range from regional impact in the UK to the focus on interaction creation in Spain. Twenty years ago the links between the industry and the campus remained under-researched but today these links have become more clear and the importance of understanding company's properties and needs are premised (Phan et al., 2005). One of the important aspects of facilitating these links between firms and universities is depicted in the article of Phan, Siegel et al., 2005 (Phan, Siegel et al., 2005). Herein, geographical proximity between firms and universities is said to promote and strengthen the links. A key factor in validating and sustaining campuses as interactive mechanisms for industry-university linkage is the expected close relationships between engineers, academic scientist, and entrepreneurs (Phan, Siegel et al., 2005).

The argument to support locating operations in close proximity to one-and-other is to benefit from various competitive and market effects. According to the article of Vila & Pages, 2008 these benefits can occur between firms and between firms and universities. Being located on a campus, as a form; promises (so called) "…essential synergy between academic institutions and firms to collaborate…"(Vila & Pagess 2008, p. 19). Therefore, exchanging intellectual property, technology and other information between cooperatives is one of the promised essentials according to Vila & Pages, 2008.

 A few studies about on-and-off site campus firms have been hypothetically compared to see how their industry-university interaction influences their performance. Remarkably, there is little (empirical) evidence available about campus on-site R&D start-ups and their relationship on the university's side (Vedovello, 1997; Griffith, 1994; Rothaermel and Thursby, 2005). Regardless of the limited empirical evidence, policymakers often take the positive effects of geographical proximity for granted. From the campus policymaker perspective, these articles are referred to in order to justify or stimulate ambitious campus building prospects (Vedovello, 1997). As an example, Figure 1 shows an aerial view of the Wageningen UR campus; where the university's knowledge institute buildings lay at the center of the campus (shot taken in 2011). Nowadays, other activities like large companies (e.g. Friesland Campina.), a start-up building (Plus Ultra) and a residence and shopping building (Plaza) also occupy the campus image. In 2017, even the multinational corporation Unilever settles a laboratory facility on the Wageningen UR campus (Resource, 2016).

However, a campus study in the Republic of Ireland showed that 'as firms grew and sought to enhance credibility and protect market shares', disadvantages emerged regarding incubator placement for starting companies. The article of McAdam & Marlow, 2007 states: "…Firm proximity created tensions concerning privacy, the protection of intellectual property and competitive strategies. It was also evident that as the firms became more mature, the need to develop independent, secure internal systems could be impeded by the ready availability of support and advice from the incubator management team…" (McAdam & Marlow, 2007, p. 78). Also, cost advantages like: 'rental subsidies' and other expenses were found to be one the most important benefit that technology tenants derive from the on-campus incubator program (Chan & Lau, 2005).

Figure 1: View of the Wageningen UR campus, showing numerous knowledge institute buildings forming the Centre of the campus (FHI, 2011).

2.1.4 The campus as a R&D start-up production environment

Three types of production environments

The article of Pouder and John, 1996 defines campus production environments as: "*Regional cluster that (1) began as a group, grew more rapidly than other industry participants, (2) compete in the same industry, (3) and have the same or very similar immobile resource requirements in the long*

run."(Pouder and John, 1996, p. 19). There are three main types (figure 2) of campus production environments that all have a different makeup of characteristics. These production environments are the engineering (1), knowledge hub (2) and creative urban (3) environment. Appendix 4 shows a range of challenges each of the environments have to face.
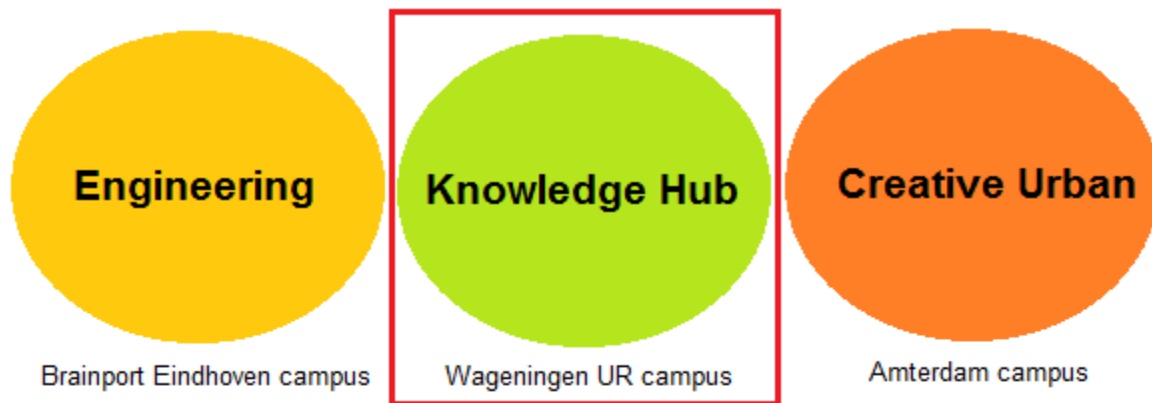
Figure 2: Three prevailing production environments for start-ups located on a campus in The Netherlands. The 'Knowledge hub' campus is part of the case of this study. The text below provides example cases of all the three types of production environments (AWTI, 2014).

Engineering environment

An engineering environment is a strong combination of companies, which together, share knowledge within an open-innovation system. Often, larger companies lay at the core of the environment. An example of a clear engineering environment is Brainport Eindhoven, depicted in figure 3. This powerful innovation machine environment connects people within the cluster, while making sure that "fresh" assets from outside the production environment are attained. This environment is often located on the outskirts of a city, usually on a terrain that was once (or still is) owned by a few large companies. These environments have a high-tech character, where larger-and smaller companies combine technologies. These technologies spurred from different companies from different (but related) backgrounds. The research capacity is low, which means these environments depend on the intellectual capacity of the companies combined and of external input (AWTI, 2014).

Figure 3: Eindhoven Campus, showing a company-based Centre with a water body at the heart of the campus (ArchitectuurNL, 2009).

Creative urban environment

In most western societies the creative urban environment is cherished as one of the most promising production environments (AWTI, 2014). According to the article of MISTRA, 2013 an urban environment creates vibrant and complex interactions among different aspects of the city. The creative urban environment is known for its lively, dense and urban characteristics (MISTRA, 2013).

Start-ups operating in such an environment are often (part-time) students, freelancers or independent personnel that have to work together. These knowledge workers prefer the city environment over other type of environments due the presence of 'all the facilities a city has to offer'. An example of the creative urban environment is the Amsterdam campus, see figure 4. The Amsterdam campus focuses innovation projects on metropolitan issues (AWTI, 2014).

Figure 4: Amsterdam Campus, showing a dense and lively city square for students and others to meet (EasyUni, 2012).

Knowledge hub environment

Public knowledge institutes are home ground and facilitators for innovation stimulation. An example is the Bio-Science Park (campus) in Leiden where large companies are situated around the university (knowledge institute, see figure 5). These knowledge institutes lay at the heart of the campus and their vision influences the development of the region. Well-developed regions can have multiple Knowledge hubs or campuses that, each, have their own specialized Knowledge hub. A region could even have a combination of engineering environments and Knowledge hub environments. The Knowledge hub environments also assists startup ventures during their development periods, which is the most important aspect of this environment. The environment can assist these ventures in coping with and tackling societal problems. This is of great importance for the environment, because this will increase value and economic throughput of the environment (AWTI, 2014).

Figure 5: Bio science park Leiden, Showing the HAL Allergy Company located near the knowledge Centre university in an open environment.

As mentioned before, the Wageningen UR campus location, according to literature used for this thesis, can be classified as a Knowledge hub environment. The Wageningen UR campus is classified as a Knowledge hub environment because the Knowledge hub center is located at the heart of the campus and its development is largely influenced according to that knowledge heart's functioning. The following section addresses the location factors of this production environment, start-up companies are possibly interested in. Besides, this section distinct these location factors based on

typical location factors that indicate preferences for the other two types of production environments.

2.1.5 Company-related campus features

Literature about the connection between companies and the campus stresses the importance of localizing a company near investors. Other articles emphasize on the American campus model (which focused on uniformity) as an essential element for mutual success (Atzema, 2008; Vedovello, 1997). Either way, as stated in section 2.1, the campus as a cluster is 'an area which contains certain location factors that bring people together'.

Other articles are more critical towards the added value of adjusting the campus towards the business sector. These articles state that there might not be a direct connection between location factors but merely to corporate extramural funding. Or as the article of Link and Scott, 2003 states: "Proximity, if other things held constant, increases success in obtaining extramural funding."(Link and Scott, 2003, p. 1348). The article of Di Gregorio and Shane, 2003 and other studies (Gupta and Sapienza, 1992; Gompers and Lerner, 1999; Sorenson and Stuart, 2001) are supporting the same (empirical) findings that geographical *localizing a venture near the investor* increases the probability that the investor invests in those ventures within a given area. This rate is almost doubled between ventures located 100 and 10 miles away (Di Gregorio and Shane, 2003). On the other side, the article of Di Gregorio, et. al., 2003 mentions that venture capital is equally distributed over geographical distances. This means that 'on campus' R&D start-ups do not have a higher chance of getting more financial venture support (Di Gregorio, et. al., 2003 p. 224). Although the general tendency among these articles mention an added value to close proximity to the campus for R&D start-ups for attaining venture support, there still remains debate among them.

This section elaborates on how the business sector is connected to a campus nowadays; through the use of location factors of the campus. Table 1 provides an overview of the location factors a campus should offer to enhance business development for companies related to the campus, according to literature. These location factors are present on all of the previously treated campuses (knowledge hub, creative urban and engineering)

What the Campus offers:	Indicator:
- **Knowledge** (Boschma, 2011; Wetering, 2006).	- **Cross-overs** (Boschma, 2011)
- **Access to labs and facilities** (Dagevos and Tomor, 2011).	- **Conditional use of labs and facilities** (Dagevos and Tomor, 2011).
- **(Financial) support** (Gregorio and Shane, 2003; Freeman & Engel, 2007; Freeman & Engel, 2007; Van Oort & Raspe, 2007; Raspe, 2009).	- **Company localizing near investor, Incubation programs** (Gupta and Sapienza, 1992; Gompers and Lerner, 1999; Sorenson and Stuart, 2001; Gregorio and Shane, 2003)
- **Eating-and meeting spots** (Dagevos and Tomor, 2011)	- **Restaurants, cafes, squares and shops** (Dagevos and Tomor, 2011)
- **presence of qualified personnel** (Dagevos, and Tomor, 2011; Zondag, 2008; Atzema, 2008)	- **Campus close to residential areas** (Dagevos and Tomor, 2011).
- **Accessibility** (Zondag, 2008; Atzema, 2008; boschma et. al., 2007, Weterings et. al., 2006)	- **Road infrastructure** (Weterings et. al., 2006)
- **Parking** (Zondag, 2008; Atzema, 2008;	- **Parking spaces** (Atzema, 2008)

- **Networks** (Wetering et. Al., 2006; Atzema, 2008; Zondag, 2008; Freeman & Engel, 2007; Van Oort & Raspe, 2007; Raspe, 2009)	- **Informal and formal networks (interaction)** (Atzema, 2008; Zondag, 2008), **communication mediation** (Zondag, 2008; Freeman & Engel, 2007; Van Oort & Raspe, 2007; Raspe, 2009)
- **Open green space**	- **Natural features** (Freeman and Engel, 2007) **space between buildings** (Vedovello, 1997).

Table 1: Overview of business-specific location factors and how the location factors on campus are indications of the type of campus production environment (Zondag, 2008; Freeman & Engel, 2007; Van Oort & Raspe, 2007; Raspe, 2009; Dagevos, and Tomor, 2011; Boschma et. Al., 2007; Boschma, 2011; Gupta and Sapienza, 1992; Gompers and Lerner, 1999; Sorenson and Stuart, 2001; Zondag, 2008; Weterings et. Al., 2006).

The article of Dagevos and Tomor, 2011 lists a range of location factors that aim to add to the economic prosperity and attractiveness of a campus. These location factors include conditional access to labs and facilities, eating-and-meeting spots and presence of qualified personnel and open green space, see table 1 (Dagevos and Tomor, 2011). The article adds that accessibility, parking, image (i.e. representativeness) and a presence of highly educated personnel are the most important location factors for companies according to the article of Zondag, 2008 and Atzema, 2008 (Zondag, 2008; Atzema, 2008).

Actual knowledge spillovers play a crucial role when it comes to the actual realization of innovative products and services (Dagevos, 2011; Van Oort, 2002). The article of Atzema adds that the campus is like a community which is connected through (the presence of) knowledge, see table 1 'presence of knowledge'. These are two different ways of interpreting this location factor. The connection is facilitated by communication between people within facilities that share a common form of interest (Atzema, 2008; Autant-Bernard, 2001). A campus can play a role in mediating this potential communication between parties, see table 1 'financial support'. Therefore, the level of presence of knowledge might mirror the same level of (financial) support that R&D start-ups need to survive (Wetering, 2006; Rothaermel and Thursby, 2005). 'Presence of highly educated personnel' of table 1 is also related, as mentioned into the article of Bok, 2009 and Zondag, 2008, in the sense that it provides 'network effects' among stakeholders on and around the campus, see table 1 'eating-and-meeting spots' (Zondag, 2008; Bok, 2009). The article of Bok, 2009 does mention this notion is based on an 'elitism' ideology that mostly serves commercial purposes of the campus, but the effects on national or regional performance of the campus are not well investigated (Bok, 2009). The effects of the 'elitism' culture of a campus originating from the American uniformity campus model. This model might have a less desirable effect on those who are not sufficiently connected to the campus (lacking 'local buzz') (Rothaermel and Thursby, 2005).

In regard to the 'networks' box of table 1: an increased integration of ICT is noticeable in every sector, and also notably within the life science sector, because the Life Science sectors is an upcoming sector in Europe but also in the Netherlands, and can, therefore, is still quite malleable in regard to IT developments (Wetering, 2006; FoodValley, 2014; Vedovello, 1997). According to Wetering, 2006 and Vedovello, 1997 (informal) knowledge networks and a good infrastructure are an import location factor for ICT campuses (Wetering, 2006; Vedovello, 1997). The article of Wetering, 2006 makes a distinction between the life science and ICT sector in the sense of different needs for R&D start-ups, but the article recognizes the increasing necessity to integrate both sectors, meaning there is an increased demand and dependency on digitalization (Wetering, 2006).

2.1.6 Aspects of the Knowledge hub

Wageningen UR campus is depicted as a Knowledge hub campus (see table 2) because it contains a strong knowledge institute core and has characteristic 'open green space' between buildings. This research focuses on the aspects of a Knowledge hub and compares it with the Wageningen UR case

to see whether the R&D start-ups value the aspects of the Knowledge hub campus. The location factor indicators fitting the Knowledge Hub production environment, mentioned in section 2.1.5: table 1, are narrowed down and elaborated in this section.

	Engineering environment	Knowledge hub environment	Creative urban environment
Presence of Knowledge (economic driver)	0	++	0
Open green space (spatial driver)	+	+	-
Diversity of activities (economic driver)	0	0	++
Close prox. of a larger company (spatial driver)	++	0	0

Table 2: Distinctive location factor properties of the three types of production environments, prevailing in literature, expected to be beneficial for R&D start-ups. The range of characteristic value of a certain location factor is indicated by a range of valuation. This range goes from '++' = 'very characteristic', to '+' = 'characteristic' to = '0' 'neutral' to '-'= not characteristic'.

Table 3 provides an overview of the specific expected benefits of a Knowledge Hub for R&D start-ups. To clarify the benefits of forming a knowledge Hub, a distinction between vertical and horizontal dimensions within the Hub is made.

The horizontal dimension is meant for companies that have comparable market niches or compete in the same sector. This competition stimulates the creation of innovation or might trigger product differentiation. Geographic proximity can be beneficial in this case because it may provide information about the opposing companies located around the company (Atzema, 2008).

The vertical dimension is companies that are on the basis of a commuting relationship. This commute relationship is connected through services, customers or products. This relationship may provide benefits for both parties in the sense of transport or transaction costs. Beside the creation of company networks, complementary relationships possess the potential to create a network of interest and stakeholders (Freeman and Engel, 2007; Atzema, 2008).

It is expected that R&D start-ups require the location factors provided by the Knowledge hub campus environment. This study takes into the account possible divergent results among the R&D start-ups per proximity range and analyses whether the results have a connection with the type of R&D start-up. To see whether the current production environment fits with the R&D start-ups this study takes into account location factors that hint towards a mix of the existing and other production environments that therefore provide insight into the results (Freeman and Engel, 2007; Boschma et. al., 2007).

Expected benefits of a Knowledge Hub (Atzema, 2008; Dagevos, 2011; Vedovello, 1997; Freeman and Engel, 2007).	transition	Expected benefits of the Knowledge Hub processed as location factors: (Atzema, 2008, Boschma et. al., 2007, Weterings et. al., 2006).
Specialized/ qualified personnel	→	Presence of qualified personnel
Slimming of labor market	→	Proximity labor market
Stimulating competition	→	Presence of similar companies
Supply/delivery market benefits	→	Proximity customers/supply companies
Resource acquisition structures	→	Accessibility by road / public transport Proximity of facilities Start-up venture support
Knowledge/ technological spillovers	→	Presence of knowledge

Table 3: Overview of main expected benefits of successful Knowledge Hubs (Dagevos, 2011) and link with location factors prevailing in literature and chose for this study treated in the previous section 2.3 (Atzema, 2008, Boschma et. al., 2007, Weterings et. al., 2006).

Agglomerative aspects of the Knowledge hub

As mentioned in the section 2.4 'Aspects of the Knowledge hub', Figure 6 shows possible influences of agglomeration properties of non-dominant production environments (engineering and creative urban) on the regional economic performance of the 'Knowledge hub' cluster environment.

Distinctive spatial characteristics of agglomeration are diversity, co-location and density. agglomeration economy effects emerge when there is a concentrations of related companies and other activities within a certain area (Van Oort and Atzema, 2004). This type of spatial concentrations emerge on the basis of shared interests. Clustering and agglomerating both have a lot of features in common, though some features opposite the two concepts. The cluster concept opposites the agglomerate concept in the sense that the focus on having shared interests does not necessarily have to lead to higher density of activities. This discourse about the right combination of specialization and variety within a cluster, should provide the most suitable production environment for all actors located on or near the campus. Besides, the potential for knowledge spill-overs, which is presumed
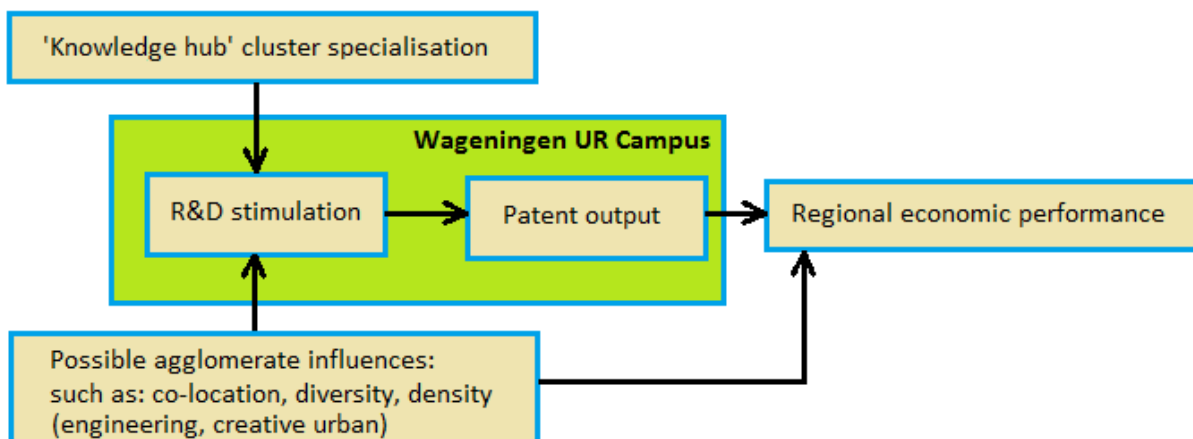

Figure 6: The possible influences of agglomeration properties of non-dominant production environments (engineering and creative urban) on the regional economic performance of the 'Knowledge hub' campus environment.

to be one of the benefits of agglomerations; opposite effects on innovation stimulation may also be a consequence of agglomerating. Costs of traffic congestion, rising ground prices and limited access to habitual access points may not outweigh the benefits of agglomeration (Weterings, 2006). An example where this is not the case is in London Tech City where a cluster of a wide range of digital companies, have raised the ground prices to such an extent that it became uninteresting for some starting ventures to settle there. This particular situation in the London tech city case shows how difficult it may then become for start-ups to settle in such agglomerates where prices are that high (Nathan et al., 2012).

The entrepreneurial Knowledge hub cluster

Due to technological advances and interaction changes between companies over time, defined benefits and relevance of geographical proximity should continuously be evaluated (Freeman and Engel, 2007). It began with the use of telephone and fax machines, where the relevance of proximity gradually became less apparent (Griffith, 1994). Nowadays, the use of internet and e-mail trafficking have influenced the acquisition of knowledge and business contacts through geographical proximity. Besides the technological advances in the field of communication, literature about clustering argues whether companies actually do profit of clustering. (Roso & Boschma, 2007).

Clusters are set-up at different scales. The presumption that companies collaborate within these clusters differs in the way a network and a cluster are both configured. These differences can be explained due to the different scales in which a Knowledge Hub cluster exists; a Knowledge Hub cluster of companies does not always mean a more effective network of companies (Griffith, 1994). The meaning and use of the term 'Knowledge Hub cluster' is gentrified in such a way that the actual use for companies is difficult to dissect into measurable performative elements (Torre, 2008). The following elements of clustering influence the functioning of an individual company; 'differences between the cluster networks', 'scales of the cluster' and 'the need for geographical proximity' (Griffith, 1994). According to policymakers clustering is great for collaboration between and attraction of companies. The cluster theory of Porter is adopted in many national and regional policy documents; though it is uncertain whether a governmental organ is capable of steering the cluster in the right direction. The 'right direction' in this sense; is the way in which malleability of the cluster can be influenced by policymakers and engineers (Porter, 2000). Part of this malleability is to know the right ratio of specialized companies to unspecialized companies per area while keeping in mind to promote diversity. All this together gives an impression of the complexity of the situation. At the same time, the opposite arguments can be brought up; how malleable can a cluster actually be, and how probable are the causality of effects of policy actions (Torre, 2008; Porter, 2000; Griffith, 1994)? These questions and marginal notes will be further elaborated in the following section 'agglomerate'.

The problem is that strong empirical evidence on the economic performance of (Knowledge Hub) cluster formation is lacking (Baptista and Mendonça, 2010). The various articles, portraying benefits of clustering vary widely among each other, also in the focus of statements about the benefits. As stated before, these benefits originate from limited points of view, excluding other perspectives. This phenomenon reveals itself in contrary to the famous article of Porter, 2000 and Pouder and John, 1996, where the growth of the region is expressed in sales (Pouder and John, 1996). Clusters are very complex. This means that simply basing 'success of the (Knowledge Hub) cluster' on the number of sales within the cluster is an overly simplified way of looking at it (Panne and Dolfma, 2003). Often, a regional scale is presumed, but the market of companies become increasingly internationalized due to technological developments over time (the internet, phone-use), reducing the necessity for companies to be situated within a Knowledge Hub cluster (at a certain scale) (Pouder and John, 1996). Another part of being in a Knowledge Hub cluster or locating oneself within such a cluster is that you presume that your company will do better there. Besides the lock-in risks of clusters, the cluster may also give the illusion of a well-functioning network (Torre, 2008; Porter, 2000; Bok,

2009). Or in other words: for whom is the network within the cluster functioning well? For policymakers, the malleability of a cluster is questionable (Bok, 2009) Improving/strengthening aspects of the cluster may exclude or inhibit other soft location factors, which were previously perceived as valuable. Besides the possible lock-in syndrome effects of close approximating to an industry-related company, literature about geographical proximity is mainly positive about this phenomenon (Der Panne and Dolfma, 2003; Pouder and John, 1996). One should ask if the benefits portrayed in literature related to geographical proximity (knowledge spillovers, knowledge networking and interactive learning etc.) are traceable in every case? The reality is complex and the entities within the given spatial boundaries; creating unique economic conditions (Hoof, 2007).

2.1.7 Summary

An R&D start-up is a small business, often defined as a firm (Auken and Neeley, 1996). These R&D start-ups can be classified based on the firm's stage and drivers, the level of independence, innovation type, economic situation and focus. These R&D start-ups can be located on a campus. A campus is an area which contains certain location factors that bring people together (Porter, 2000; Vedovello, 1997). The campus can therefore also be the production environment of R&D start-ups. There are three archetypes of campuses as production environments. These archetypes are the engineering (1), knowledge hub (2) and creative urban (3) campus. Wageningen UR campus is specified as the Knowledge Hub environment in which knowledge institutes lay at the heart of the campus and their vision influences the development of the Wageningen UR campus. Consequently a campus, as a production environment, may influence the internal functioning of the firm due to various location factors of the campus (Wetering, 2006; Vedovello, 1997). These location factors can be divided into cluster and agglomerate specific location factors that are present in various ratios at every campus. The Knowledge Hub campus is typified by dominated by cluster specific location factors (especially: the presence of knowledge and open green space) and distinct itself from other campus archetypes (AWTI, 2014; Atzema, 2008; Vedovello, 1997).

2.2 Analytical framework

Figure 8 of 2.2.1 'Framework explanation' below provides an overview of the framework containing directions for assessment of the results. Besides providing directions, the framework sets the boundaries in which the data can be explored and which aspects of the concepts are used for answering the research questions. The text below the framework model provides an explanation/interpretation of the framework. The second chapter 2.2.2 'framework and research questions' elaborates on which aspects in the framework assist in answering the research questions.

2.2.1 Framework explanation

This section elaborates which choices were made in selecting the aspects of the concepts that support answering the research question. Besides the actual framework model, this section of the research provides an explanation/interpretation of the framework. Table 7, shows an overview of the aspects, mentioned in the framework of figure 8.
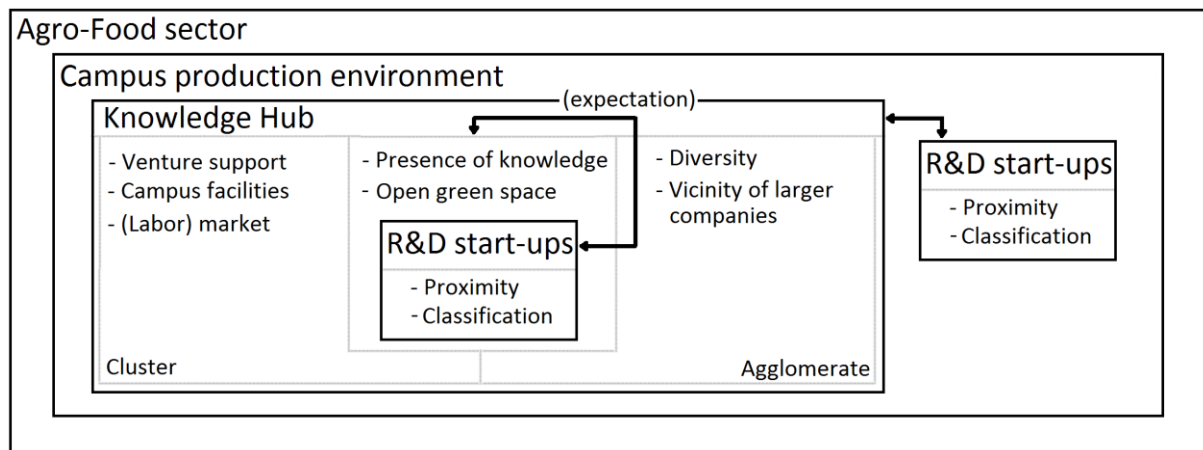
Figure 8: Analytical framework; showing the connection between various aspects of concepts. The thick line between the start-ups represents what is to be expected (as to what the knowledge provides), while the dotted lines explains other spatial, economic or perceptive preferences (author's own work, 2017).

R&D start-up companies on-and-around the Wageningen University UR are located in a Knowledge hub campus production environment, as is shown in figure 2. The Wageningen UR campus is also part of the production environment of the R&D start-ups that are located more remote from the campus (depicted as part of the production environment, see framework (figure 8). The R&D start-ups are classified by the classification factors (see section 2.6 Characteristics of R&D start-ups) and by their geographical proximity to the campus; to see whether the preferences differ between the start-ups at three different proximity ranges. Secondly, the results are analyzed to see whether there is a correlation between the R&D start-up characteristics per proximity range. This paragraph briefly elucidates parts of the analytical framework.

General info on the framework

Thick arrows in the framework are the core of this research. These arrows combine aspects of the analytic case. The location factors portrayed in the framework are situated within a certain 'box' because they are distinctive for that 'box': e.g. the Knowledge hub box contains both 'cluster' and 'agglomerate' types of location factors.

In the written interviews, the location factors are, in some cases presented to the R&D start-ups in multiple forms. Diversity, for instance, is presented as 'meeting spots/opportunities' and 'diversity of lively activities'.

R&D start-ups (criteria)

Not making a distinction between R&D start-ups would make it difficult to evaluate the results with regard to the heterogeneity of the R&D start-ups. To prevent this, the criteria (classification) of R&D start-ups distinct the R&D start-ups in separate groups and at various distances (geographical proximity), shown in table 5.

Campus hubs (campus location, cluster, agglomerate)

'Expectation', in the framework, means that for this research it is expected that R&D start-ups in the Agro-Food sector prefer the distinctive location factors of the Knowledge hub: 'presence of knowledge' and 'open green space'. This campus production environment, as a holistic concept, is shown in the theoretical framework, figure 8 as the outer border for the rest of the concepts situated within the Agro-Food sector box. Other investigated R&D start-ups outside the Knowledge hub production environment are also part of the Agro-Food sector, therefore those R&D start-ups remain within the Agro-Food sector domain.

Selected start-up classification criteria

As portrayed in the second row of table 5 of section 2.1.2 'Characteristics of R&D start-ups', five classification criteria are selected for answering research question 1 'What are the R&D start-ups characteristics and how can they be classified?'. These five criteria are: stage of growth, intensity of university connection, market and technology, market location and firm type. These criteria are used to distinctively separate the data per proximity range. These five aspects are part of the holistic characteristics, namely: stage and drivers, level of independency, type of innovator, economic situation and focus of the firm, see first row of table 5 of section 2.1.2 'Characteristics of R&D start-ups'. No more than five aspects are chosen, because selecting more criteria will make analyzing the results too complex. Narrowing the criteria to five criteria is therefore the maximal amount of criteria to analyze the data in this study. The selected criteria are portrayed below:

- Stage of growth
- Intensity of university connection
- Market and technology
- Market location
- Firm type

The choice for selecting each of the criteria is elaborated in this paragraph. The selection is based on the choice of the author based on the significance portrayed by the investigated literature and the added value of those characteristics for the Wageningen UR campus case. This is done by estimating (brainstorming) about the characteristic's significant contribution, applicability and importance in relation to the research.

The following section elaborates on how the specific research question are answered through the use of this framework.

2.2.2 Framework and research questions

Specific research questions

1.   What are the R&D start-ups characteristics and how can they be classified?

The first step is to use the selection criteria from section 2.1.2 'Characteristics of R&D start-ups' which describes how R&D start-ups in the Agro Food sector can be classified based on their properties. The second step is apply take the analytical framework of section 2.2.1 and set-up the interviews in such a way that they can fill in or communicate what type of R&D start-up properties fit their venture (through sending out written interviews).

2.   To what extent do the location factor preferences differ to R&D start-ups that are located on (1) / near (2) / or relatively far (3) from the campus?

The face-to-face and written interviews provide valuable information about the extent to which the location factors, provided within the framework, are represented and of importance to R&D start-ups on-and around the Wageningen UR campus. Expectation (thick arrow, figure 8) is that R&D start-ups closer to or on campus make more use of the location factors present on that campus. This means that the various proximities and its results are compared. Location factors not distinctive to the Knowledge hub campus (i.e. diversity, density, large company presence related) are also binoculars in explaining any deviating results.

3. Methods

This section begins with explaining the Wageningen UR campus. Besides the literature review, the approach used for conducting this research is described in the sequential section.
Two methods are used for this study. These methods are literature review (method 1) and case study of Wageningen UR campus (method 2). The qualitative research method is there to test made assumptions based on the literature review and the case in the second approach. The assumptions based on the literature, later discussed in the results chapter, were developed through insights and gained knowledge during the study. The qualitative research method is split into three 'research tools', namely as document studies, written interviews and semi-structured open interviews. Different aspects of the approach will be elaborated, concerning the R&D start-up and campus connection of the study, data collection procedures, research design, data analysis interpretation, data recording procedures and validity and reliability.

3.1 Case: Wageningen UR campus

The Wageningen University & Research center (Wageningen UR) campus is a terrain on the north side of Wageningen that exists of a Dutch University and a number of commercial companies. Wageningen University, before it was known by its current name, was founded in 1918, formerly known as 'the National Agriculture University'. The Mansholtlaan connects the campus to the nearby highway A12. This highway is the main entrance route for reaching the campus. Besides the name change of the university 1998 to 'Wageningen UR', its policy and strategy changed with it. Around the campus and on the nearby industrial zone (Agro Business Park), medium and smaller sized companies, start-ups and experimental fields occupy the outskirts around the campus (Archieven, 2014; Haar, 1993).

Gradually, more facilities moved from a location across the city to the Born. The Dreijen used to be one of the main chemistry-based research and education locations. Nowadays the old buildings are used as temporary student houses and some laboratory equipment on the Dreijen is still being used to this day. In 2003, the removal of the IVT and other buildings led to the creation of the Forum and Atlas buildings in 2007. Besides the practical and education halls and rooms, these buildings were also designed to provide a location for the researchers, Environmental Groups and education faculties as well. In 2009 the Radix building was created for mainly the Plant Sciences Group and faculties. The Forum building also houses the university library and 'Van Hall Larenstein' until 2015. The Orion finished in 2013. This building was designed to cope with the increasing student growth of the university. This building contains the largest classroom; providing room for 2600 students in total. Larger companies already located on campus improved their cooperation and interdependence over time. In 2013 FrieslandCampina opened a second facility on campus (Archieven. 2014; UR, 2012). In 2016, the start of the year the Ultra plus building finished. This building provides office locations, clean rooms, and laboratories for various small companies, mainly start-ups (Kadans, 2015). Most recent development on campus is the Plaza building on the southwest side of the campus. This building is the first building that realizes student housing on campus. Besides housing students, Plaza has a day-care, supermarket, meeting-room, technological hall, and incubation locations (De Gelderlander, 2014)

The main start-up incubation and support counter of the Wageningen UR campus is StartLife. Startlife is supported by an entrepreneurial company 'KLV', which connects businesses with the campus. Startlife also consists of another separate student start-up support organization called

'Starthub'. Both the organizations provide locations and (financial) support for collaborative companies and start-ups (Director, 2016). Besides incubation programs, the venture support counter collaborates with R&D start-ups across the sector and even between other sectors (Director, 2016).

3.2 Description of the respondents

The results of the online written interviews are the focus of this section. These written interviews were sent to the respondents in the mid-period of April 2016. In total, 243 R&D start-up companies received the written interviews, of which 48 companies replied. The R&D start-ups were selected by selecting as much R&D start-ups as possible. These R&D start-ups were selected by searching on the internet for them and using a dataset of an anonymous source. Of the approximately 280 R&D Agro Food R&D start-ups

Figure 9: Type of company, authors own work.

related to Wageningen UR, to 196 R&D start-ups, the written interview invitation was sent. 47 R&D, start-ups from outside the Food Valley region, that are connected to the Wageningen UR campus also received the written interview invitation. Table 4 and 5 show the properties of both the face-to-face interviewed R&D start-ups and organizations. It was difficult to find all R&D start-ups in and around Wageningen and other parts of the Agro-food sector, because not all R&D start-ups had a website or were registered.

Figure 10: R&D start-ups that made use of an incubation program,

This resulted in a response rate of 19.75%. Of the companies that did not fill in the written interviews, 4% refused to cooperate and 13% of the companies did not exist anymore or were unrelated to this topic (due to bankruptcy, wrong e-mail or because their company was more health/tech related). Information about why they could not fill in the written interviews was often explained over the phone. Some said they reconsidered filling in the written interviews over the phone. The e-mail addresses were either attained through searching the internet for addresses or through connections within the university. During this period, the face-to-face interviews also were conducted until the beginning of June. After two weeks after the first mail was sent, another e-mail was sent to the respondents. Three weeks after the second mail, a third mail was send, because the second mail was sent just before the holiday period in May. For this study 48, start-up companies' written interviews results were analyzed. Of these R&D companies, various characteristics were asked. These characteristics are portrayed in this section.

This paragraph elaborates on the various characteristics of the R&D start-ups. These R&D start-up companies were either located 'on campus' of Wageningen UR, around the campus (0-2 km) and relatively far distant from the campus (> 5 km). These R&D start-ups may have or not have a connection with the university or any other kind of Agro-Food knowledge institute. The differentiation in connection with the university is made within the following results section. Most of these R&D start-ups are independent companies (81.3%), see figure 9. Part of these R&D start-up companies is funded or founded by a larger company or institute, hence 12.5% spin-offs or 3.5% daughter companies. The remaining companies do
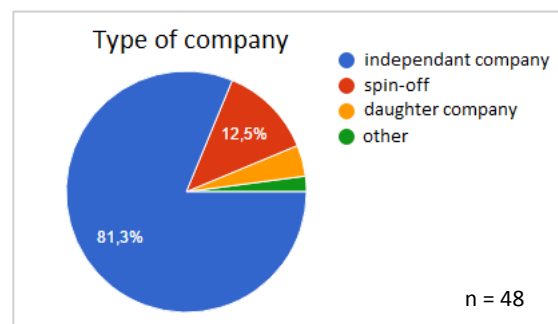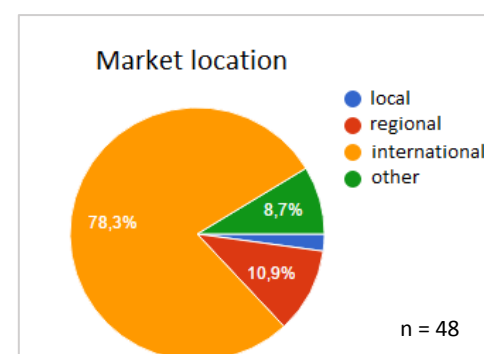
Figure 11: Market location of the R&D start-up companies, author's own

not fall under one of these three categories and are depicted as 'other'. Of these 48 R&D start-ups, 70.2% made use of an incubation program, provided by a third party. This third party incubation support could, for instance, be provided by the campus or other venture supporting organizations within that region, see figure 10. The years in which the R&D start-up companies were founded range from 1990 until 2016. Most of the companies that responded were founded between the period of 2006-2012 (95.8%). Figure 11 shows another interesting feature, namely that most of the R&D start-ups (78.3%) have their market located internationally.

Characteristics of face-to-face interviewed organizations (n=6)						
Interview questions:						
	Organization A	**Organization B**	**Organization C**	**Organization D**	**Organization E**	**Organization F**
Does your company focus on specific R&D start-ups?	Agro-Food related	No	No	Innovative R&D start-ups	No	Student related
Type of company/organisation?	Faculty of the university (WUR)	Campus developer	Campus investor	Campus investor	Large company	Large company

Table 4: Characteristics of the face-to-face interviewed organizations (n=6).

Characteristics of face-to-face interviewed R&D Start-ups (n=7)							
(Interview) questions	Start-up A	Start-up B	Start-up C	Start-up D	Start-up E	Start-up F	Start-up G
What is the proximity of the R&D start-up to the campus?	On campus	On campus	On campus	0-2 km	>5km	2-5 Km	>5km
4. What type of company is it?	independent company	independent company	spin-off	independent company	independent company	independent company	daughter company
5. When was the company founded?	2016	2014	2016	2014	2006	2001	2002
6. When did you move to your current destination?	2016	2014	2016	2014	2008	2001	2010
8. Did your company make use of an incubation program?	no	yes	no	yes	no	yes	yes
9. In what phase is your company?	Selling of product/service	Selling of product/service	Selling of product/service	Selling of product/service	Selling of product/service	Selling of product/service	Selling of product/service
10. How well are you connected to the university?	barely	barely	average	average	average	good	average
11. In what kind of market is the company situated?	new market	new market	old market	old market	old market	old market	old market
12. What kind of technology does the company use?	Established technology	A combination of both	New technology	New technology	Established technology	A combination of both	Established technology
13. Where is your market situated?	international	international	national	international	international	international	international
14. What is the focus of the company?	production/ service provision	product improvement / service provision	production (digital)	production	service provision	production	production

Table 5: Characteristics of the face-to-face interviewed R&D start-ups (n=7).

3.3 Interviews: qualitative research design

'Face-to-face' and 'written interviews'

Two approaches for the qualitative research were applied in order to attain the data from the target groups. These two research methods are the use of 'written' and 'face-to-face' interviews. The interviews and the written interviews contain the same questions, these means that the method 'qualitative research' is inherently the same. The data retrieved from both the written interviews and the interviews are generally covering the same content, the difference is that with interviews there is the possibility to ask follow-up questions. Besides asking follow-up questions. The face-to-face interviews are there to get the 'hard data' of the written interviews and to see whether the concepts used in the written interviews cover the opinions (soft data) of the start-ups and policymakers and larger companies. The interviews with the policymakers and larger companies could hypothetically support the data from the document analysis, which, together, might backup comparison of the face-to-face and written interviews results between the start-ups and the policymaker/larger companies. The face-to-face interview questions are depicted in appendix 3 and the written interviews can be found in appendix 2 shows the set-up of the written interviews approach. Table 7 provides an overview of the connection between the research questions, theories, aspects, and approaches.

The written interviews are there to get the 'hard data' from the start-ups and the interviews are done to support the interpretation of the results of the interviews. Besides interviewing the start-up companies, the policymakers (campus investors/developers) and larger companies are interviewed as well. See table 4 to see the properties of the policymakers and larger companies. Larger companies and policymakers are interviewed regarding the preferences of the start-ups, to provide insight in whether the results from the start-ups and the policymaker/larger companies correspond or not.

The qualitative and quantitative research method is selected for this study, so necessary information about the Agro-Food sector and R&D start-ups can confirm the findings due to the application of different research methods. The interviews will determine which location factors (concept) are preferred by the start-ups and how this relates to the view of the larger companies and policymakers on their preferences.

Face-to-face interview approach is selected for this study because it provides a balance between flexibility and control. Another reason to keep the data collection method for interviewing semi-structured is because this makes it easier for the interviewee to make their answers more narrative.

The qualitative research method is applied for this research. This method is selected because a number of respondents of the written interviews was not sufficient for it to reject or accept a hypothesis. The written interviews results are analyzed by comparing the data in the sense of selecting the data based on the classification criteria. The character of the thesis work is of explorative as well as explanative nature. It is an explorative research because a similar study for this specific case has not been done before. The explorative character of the research refers to the way start-ups perceive certain location factors and how this affects their functioning at the Wageningen UR campus.

Data collection procedure

For this study, the Wageningen UR campus case is selected because it is the only mature agro-food campus in the Netherlands. Some agro-food R&D start-ups were located around other agro-food knowledge clusters. An example of an agro-food knowledge cluster is Grow Campus (Den Bosch). Input from R&D start-ups was related to their perception of the expected benefits of the Wageningen UR campus, and not the nearest Agrofood "knowledge cluster". The core content (answers) of the face-to-face semi-structured interviews are noted in summary instead of using the transcribing method. The content is summarized, because for this thesis it is more interesting to identify only the main ideas of the interviewee. Or as the article of Mershon, 2010 states that information collected may or may not be relevant to the topic or provide added or new understanding to the body of knowledge (Mershon, 2010). Digital tools used during the research period are Google maps, internet browser and searching machines and an anonymous dataset.

This data collection method is important to get insights about how initiators communicated their initial ideas, but also how the interviewees perceived these ideas and possibly influenced the initiative. Having an interview, one-to-one usually means less censorship because of the absence of other parties involved in the initiative's process. Additionally, qualitative documents such as official documents from provincial, regional, municipal and local documents from the regarded authorities are collected. This research aims to generalize R&D start-up groups in some way by producing accurate portrayals of its subject matter, progressing towards objective truth and scientific expertise (Gergen & Gergen 2000). For reliability and validity of the study; 12 semi-structured face-to-face interviews were conducted, of which: '7 R&D start-ups', and '6 policymakers/large companies' (these are specifically: 1 faculty of the university, 2 campus investors, 1 campus developer and 2 large companies). Throughout this thesis, for simplification, these interest groups are often referred to either as: 'R&D start-ups', 'policymakers' or 'large companies'.

Research questions	Concepts	Aspects of concepts	Methods	Interview questions (appendix 2)
1. What are the R&D start-ups characteristics and how can they be classified?	-R&D Start-up characteristics (Robson and Bennet, 2000, Chan and Lau, 2005, Felsenstein, 1994, Clarysse et al., 2005)	R&D start-up characteristics: - Stage of growth (Robson and Bennet, 2000, Chan and Lau, 2005) - Intensity of university connection (Felsenstein, 1994, Clarysse et al., 2005) - Market and technology (Clarysse et al., 2005) - Market location (Clarysse et al., 2005) - Firm type (Clarysse et al., 2005)	- Literature review - Face-to-face interviews - Written interviews	Can you provide the following information about your company? 4. What type of company is it? 7. What is your relative distance to the campus? 8. Did your company made use of an incubation program? 9. In what phase is your company in? 10. How well is your company connected to the university? 11. What type of market does your company have? 12. Which type of technology does your company use? 13. Where is your market mainly located? 14. Wat is your company's focus
2. To what extent does the variable 'proximity to the campus' play a role in preferring a certain production environment and how does this relate to the various classified R&D start-ups?	- Production environment (IMBO, 2014). - Campus (Aztema, 2008; AWTI, 2014) - Location factors (agglomerate, cluster, soft and hard) (Dagevos, 2011; Buursink, 1991)	Knowledge Hub location factors: - Vicinity larger companies (Weterings et. al., 2006) - Diversity (Van Oort and Atzema, 2004) - Green open space (Atzema, 2008) - Proximity (IMBO, 2014).	- Literature review - Document Analysis - Face-to-face interviews - Written interviews	How important are the following location factors? 15. Presence of knowledge on campus (university or other companies) 16. Venture support (venture capital, rent price, personnel) 17. Use of facilities on campus (Lab, IT, restaurant) 18. Vicinity of customers and suppliers (contract, control) 19. Presence of highly educated personnel (quality, choice and price) 20. Meeting opportunities on campus (events, meeting spots) 21. The green environment and space between buildings 22. Diversity of 'lively' activities in the vicinity of the company (shops, restaurants, cafés) 23. Large Agro-Food company in the proximity (related to your company)

Table 6: Overview of the connection between the research questions, theories, aspects and approaches.

Data recording procedure

The data recording procedure is important for this study because it allows better analyze of the story of the interviewee. For the data recording procedure, an audiotape was used to collect the data. This means that protocols were used to steer data collection and to make sure that essential data would be attained. During the interviews/meetings in regard to the expected location factor benefits of the campus, side notes were made over non-verbal messages and attitudes (DiCicco-Bloom and Crabtree, 2006).

Data analyze and interpretation

The data is analyzed and interpreted after the data collection. During this study, there was no priority as to whether a certain data collection approach was conducted before the other. The reason why this did not have priority, is because the interviews and written interviews covered the same content and questions, therefore no priority was needed, providing flexibility in the collection sequence. During the data gathering, replies on interviews questions were followed-up by additional questions (follow-up questions) that were based on previous experiences or insights gained after retrieving the written interviews results or by previous interviews. Interpretation and data analysis is a continual process, in which the data can be categorized into a range of pre-estimated themes. The document analysis is executed by counting the words and meanings that belong to the separate themes, otherwise known as coding (Basit, 2003).

The first step in the total data collection procedure was to collect the available data from the written and face-to-face interviews one-by-one. For each recorded face-to-face interviews, the audio tapes' content was summarized and linked to the relevant side notes made during these interviews. Subsequently, the data was viewed and read by the author, giving an initial impression of the data from the face-to-face and written interviews. The impressions from the data of the face-to-face interviews were then used in following face-to-face interviews to ask follow-up questions that are related to the previously attained information. And finally, in case deviating data from the face-to-face and written interviews was attained, the author used that deviating data to adjusted/sharpened the codes used for the analysis of the policy documents.

An example of a code that required further interpretation for coding is the location factor/code: 'proximity of labor market'. 'Proximity of labor market' appears in various forms in the policy documents. For instance, like: 'references to strengthening or improving labor markets' but the policy documents never state the code literally or specifically as 'proximity of labor market'. After the research was conducted the addition of 'image' within the written interviews would have been optional, considering the outcome of this research. Not having included this location factor, actually gave interesting results regarding the inherent connection between other location factors and 'image'. These results are elaborated within chapter 5 'Conclusion' and provide an opportunity for further research.

Validity and reliability

Validity tests the accuracy of the findings of a research (Gibbs, 2007 in Creswell, 2014). At least three strategies are used to achieve this. First, the data sources are triangulated: different sources of data are used, as mentioned in the data collection section. Second, member checking is applied. The interpreted stories, storytelling and space/place perception are checked by the participants for their trustworthiness and relevance. Third, the research outcome consists of a rich and thick description by using different data sources. Reliability indicates that the approach is consistent across different researchers and projects (Gibbs, 2007; Creswell, 2014). In total 73 literature sources were used, ranging from scientific articles, archives, websites to books. In this study, it is important that procedures are documented in different steps so that others could follow these procedures, especially for the generalization of findings (Yin, 2009) as an outcome of the study analysis. It also

sought to examine outside influences, which could be considered instrumental in shaping the R&D start-ups motivation to localize the business at a certain spot. The policymakers, campus investors/developers, and larger companies' insights were thought to be important groups who have critical advisory roles in regard to shaping and molding motivations of R&D start-ups to come to a campus. It was, therefore, felt necessary to construct a research design that took into account, not just the perceptions of the R&D start-ups, but also those of the other organizations. This kind of triangulation not only illuminated the same issues from three different perspectives but also manifests to what extent the perceptions of these groups are aligned.

3.4 Document study

The various policy documents were analyzed by coding. There are several coding techniques. The coding technique used for the documents is 'descriptive'. The absence, sparseness, or incompleteness of documents should suggest something about the object of the investigation or the people involved (Bowen, 2009).The descriptive variant of coding is used so various variations of text related to the code fall under this category of code. The codes are based on the location factors. These codes are: presence of knowledge, venture support, use of facilities, quality of open space, proximity of local market (customers), and presence of (highly educated) personnel, based on the location factors used in to analyze this research. These codes can then be categorized to see whether they fit one of the related production environments. Parking opportunities, accessibility and vicinity of other start-ups were used in the written interviews as control group variables. Adding control variables adds to the validity and reliability of the study (Basit, 2003). The policy documents were developed by different sources, ranging from 'a campus vision plan' to 'a provincial internationalization document'. Document study on strategic agendas, area plans / visions of Food Valley alongside provincial and national policy (along with interviews with policymakers) in return gives information on how the region envisions the production environment for R&D start-ups. The written interviews results in return validate whether that is the case. The list below sums up the 6 analyzed documents.

- Op weg naar een Strategische Agenda FoodValley 2015-2019
- 'Internationalisering Provincie Gelderland: Acquisitiestrategie en- organisatie'
- 'Wageningen campus strategy: Gateway to smart food in a green world'
- 'Gebiedsvisie regio FoodValley'
- 'Inspiratiebeeld: Regio FoodValley'
- 'Innovatieprogramma AgroFood Noord Brabant 2020'

4. Results

This chapter contains the results of the study. Section 4.1 'interview questions' contains the interview questions and explanation of its relevance for this study. Each of the investigated location factors from the policy documents, written and face-to-face interviews are provided in the sections 4.1 to section 4.3. Appendix 5 contains a summary of the most apparent results of the written interviews.

4.1 R&D characteristic per proximity range

This section analyses the characteristics per proximity range. Table 7 provides an overview of the characteristics of R&D start-ups per proximity range. The results of table 7 are applied in chapter 6 'Discussion'. Discussion to analyze whether the characteristics of start-ups per proximity range are linked to the valuation of location factors of section '4.2 valuation of location factors'. The numbers before the interview questions are related to appendix 2 which contains the interview questions used for this research.

This paragraph contains observations of characteristics of R&D start-ups that are similar over all the proximity ranges. All proximity ranges tend to have a similar mixture of type of companies (question 4), which predominately exists of 'independent' companies. There is a steady expected decline in R&D start-ups over the proximities ranges that made use of an incubation program (question 8). Also, (question 13) at every proximity range most companies have their market situated 'internationally'. The connection with the university (question 10), apart from the results of 'on campus' R&D start-ups, gradually decreases over the proximity ranges, as expected.

On campus

What deviates R&D start-ups located on campus is that they all use a 'new technology' (question 12) compared to R&D start-ups located at other proximity ranges and the focus of the start-up tends to be very 'production' based. Another observation is that R&D start-ups located on campus have the worst connection with the university of all proximity ranges (question 10). Also, R&D start-ups located on campus are generally more production based (question 14).

0-2 km and 2-5 km

Most remarkable deviating characteristics of R&D start-ups are observed within the 'on campus' and '>5 km' proximity range. The '0-2 km' and '2-5 km' have similar characteristics with each other and the other two proximity ranges. Also, the proximity ranges '0-2 km' and '2-5 km' fit within the expected decline or increase of characteristics over the increasing geographical distance.

>5 km

Companies located at the > 5km range tend to have more R&D start-ups that are in the 'setting-up' and 'beginning of marketing of product/service' phase, where other proximity ranges are either in the 'selling of product/service' or 'product/service development' phase. R&D start-ups located at the > 5 km

proximity range (question 11) have the highest ratio of companies functioning in an 'old market'. It is generally also expected that 'old market' R&D start-ups are situated further away from the campus, because campuses attempt to attract R&D start-ups that are innovatively distinctive (Foodvalley, 2014). This also means that those R&D start-ups are distinctive enough to function within a new market. (question 14) R&D start-ups located at the > 5 km proximity range have a distinctively higher ratio of R&D companies that have their company focus on '(product) process improvement'.

	on campus	0-2 km	2-5 km	> 5 km
The amount of companies (n = 48)	n = 6	n =10	n = 9	n = 23
4. What type of company is it?				
daughter company	0	1	0	1
spin-off	2	0	1	3
independent company	4	9	8	18
other	0	0	0	1
5. When was the company founded (average)?	2000	2010	2010	2008
6. When did you move to your current destination (average)?	2014	2011	2011	2013
8. Did your company make use of an incubation program?				
yes	4	3	3	6
no	2	7	6	17
9. In what phase is your company?				
Setting-up	0	0	0	4
beginning of marketing of product/service	0	0	0	2
Selling of product/service	5	7	6	10
product/service development	1	3	3	7
10. How well are you connected to the university?				

good	0	2	3	3
average	1	5	4	6
barely	5	3	2	14
11. In what kind of market is the company situated?				
new market	3	6	3	6
old market	3	4	6	17
12. What kind of technology does the company use?				
Established technology	0	2	1	5
New technology	6	3	3	6
A combination of both	0	5	5	12
13. Where is your market situated?				
local	0	0	0	1
regional	0	2	0	3
national	3	1	0	0
international	3	7	9	19
14. What is the focus of the company?				
(product) process improvement	**0**	0	1	6
product improvement	1	4	2	6
production	**5**	3	2	7
Service provision	**0**	3	4	4

Table 7: Characteristics of the group (n=48) of investigated R&D start-ups located at various proximities to the Wageningen UR campus based on the interview questions of appendix 2.

Table 8 shows that the most recurring location factors within the documents are 1) presence of knowledge (30%), 2) venture support (15%), 3) facilities (14%), 4) diversity of activities (12%). These results are used in section '4.2 valuation of location factors' to support the findings per location factor.

Policy document	Presence of knowledge	Venture support	Use of facilities	Proximity (labor) market	Highly educated personnel	Diversity of activities	Meeting spots /opportunities	Open green space	Larger company	Total:
Average score from written interviews (scale: 1 to 5)	3.8	3.3	3.4	3.1	3.7	3.0	3.3	2.8	2.0	
Gebiedsvisie Regio FoodValley (Knaap, 2013)	507	290	95	107	31	350	55	230	114	1779
percentage:	28%	16%	5%	6%	2%	19%	3%	13%	6%	
Inspiratiebeeld regio Food Valley (Communicatie, 2014)	274	0	7	30	20	82	20	56	0	489
percentage:	56%	0%	1%	6%	4%	17%	4%	11%	0%	
Internationalisering provincie Gelderland (Arcusplus, 2013)	461	306	134	121	239	72	0	0	75	1408
percentage:	33%	22%	10%	9%	17%	5%	0%	0%	5%	
op weg naar een	208	74	92	38	30	44	109	32	11	638

strategische agenda (FoodValley, 2014)										
percentage:	33%	12%	14%	6%	5%	7%	17%	5%	2%	
Wageningen Campus Strategy (Breukink and Buitenshuis, 2013)	3	119	179	8	3	50	73	0	0	435
percentage:	1%	27%	41%	2%	1%	11%	17%	0%	0%	
Average count percentage of the policy documents	**30%**	**15%**	**14%**	**6%**	**6%**	**12%**	**8%**	**6%**	**3%**	

Table 8: The counts of the amount of codes and percentages of the codes in relation to all pertaining codes within a certain policy document. These codes are used to identify the content priority of the pertaining location factors.

4.2 Valuation of the location factors

4.2.1 Presence of knowledge

Questions:

1.   Presence of knowledge on campus (university or other companies)
Very unimportant   1◊ 2◊ 3◊ 4◊ 5◊   Very important

2.   To what extent is the presence of knowledge of the campus for a startup of interest? (Or is the affordable rent more important for instance?)

Written interviews:

Presence of knowledge	(n= 6)	(n= 10)	(n= 9)	(n= 23)	(n= 48)
(n)	On campus	0-2 km	2-5 km	>5 km	total
Very unimportant (1)	1	0	0	1	2
Not important (2)	0	1	0	5	6
Neutral (3)	3	0	1	3	7
Important (4)	0	3	5	8	16
Very important (5)	2	6	3	6	17
Average (Scale: 1 to 5)	3,3	4,4	4,2	3,5	3.8

Table 9: Average score and number of respondents (R&D start-ups) per score class (1-5) divided over four distances to the campus for location factor 'presence of knowledge'.

Table 9 shows that R&D start-ups located on campus class rate location factor 'presence of knowledge' the lowest (3,3) and R&D start-ups located beyond 5 km class rate presence of knowledge the second lowest (3,5). Table 15 also shows that R&D start-ups located between 0-2 km class rate location factor 'presence of knowledge' the highest (4,4) and R&D start-ups located between 2-5 km class rate 'presence of knowledge' the second highest (4,2).

What is remarkable is that at the distance 'on campus' the score is only 3.3. This score is relatively low compared to the other proximities while it is the proximity range closest to the campus. From the proximity range '0-2'onward the score gradually decreases, as expected.

Policy document analysis:

Another document about the FoodValley region, 'Gebiedsvisie regio FoodValley' of Knaap, 2013 mentions that "...the incubation terrain is a breeding ground for knowledge transfer...". One of the most recurring categories of the document of Knaap, 2013 document is 'presence of knowledge'. The document about the FoodValley region, 'Inspiratiebeeld: Regio FoodValley', focuses on companies in general, where the role of the knowledge heart (Wageningen campus) and other

knowledge institutes are stressed. The most recurring category of the document of Communicatie, 2014 is 'presence of knowledge'. The presence of knowledge in the article is interpreted as "…Knowledge transfer between companies and knowledge providers is the main challenge…" (Communicatie, 2014, p. 34). The article also conically states the importance of knowledge in the sense that "…Regional knowledge centers are structure bindings between knowledge institutes and businesses…" (FoodValley, 2014).The document of 'op weg naar een strategische agenda' from FoodValley, 2014 states that local knowledge sharing between smaller companies and knowledge institutes is one of the region's goals. Also working locations for starting ventures on-campus is mentioned as a benefit in supporting the goal to share knowledge between knowledge institutes and smaller companies. The 'Wageningen Campus Strategy' document of Breukink and Buitenshuis, 2013 shows that the dedicated services offered on page 13 do not include knowledge transfer benefits but other services instead (like legal and tax) (Breukink and Buitenshuis, 2013). This may imply that the 'presence of knowledge' is not intended as a knowledge transfer from the university's point of view.

None of the policy documents are able to explain the deviating results (score 3.3). The policy documents do mention that closer proximity increases knowledge transfer, therefore the expected decrease (from score 4.4., 4.2 to 3.5) over the proximities fits with the narratives of the documents. Table 7 shows that R&D start-ups located on campus do have the worst connection with the university compared to other proximities while these R&D start-ups are located closest to the campus. Also these R&D start-ups are mostly production orientated. At other proximities the R&D start-ups have a more diverse company focus (this includes more: 'service provision', '(product) process improvement', 'product improvement as well').

Face-to-face interview: R&D start-ups:

The following location factor 'presence of knowledge' and the extent to which this is important for the R&D, is asked to the various R&D start-ups located around the campus. In general, the opinions about the presence of knowledge varies, and it seems that the presence of knowledge attracts the presence other location factors useful for the R&D start-ups as well. To explain the result score 3.3 on campus of table 13, the face-to-face interviews with 'on campus' R&D start-ups backed up this finding. Start-up A (on campus) replied the presence of knowledge could be handy, but the start-up experienced that access to knowledge (and facilities) is not always obvious. R&D Start-up A and C (On campus) replied that the presence of knowledge is not the detrimental factor, but the extent to which the start-up has access to knowledge is. Start-up B (on campus) for instance mentions that it would like to receive affordable access to the library (this includes knowledge), but that access currently is too expensive for this starting venture.

The gradual decrease of score table 13 from 4.4 to 4.2 and 3.5 is what is expected according to the provided theory. Start-up D (0-2 km) replied that the presence of knowledge is not that important for the business, only that the connection of his colleague with the university made him decide to visit him and eventually located the business in Wageningen. Start-up F (2-5 km) replied that the presence of knowledge was very important for them, because the founder had studied in Wageningen and from time to time they hire specialized personnel from the university to provide knowledge about different types of stock animals. Start-up E (> 5 km) replied that presence of knowledge as a location factor is also not important for them, because they already had the needed knowledge with the company; it was more the financial support that they needed. This made them decide to go for financial support to a Biotech company in Leiden. Start-up G (>5km) replied that the presence of knowledge is very important, because of eleven employees; five of them studied in Wageningen. Among R&D start-ups of the various proximity ranges there seems to be inconsistency. For some R&D start-ups at a certain proximity range knowledge was very valuable and for the other it was not. The R&D start-ups at within the same proximity range seem to have different needs that were not connected to the presence of knowledge of the campus.

Face-to-face interview: organizations:

Organizations were asked to what extent 'presence of knowledge' is of importance to R&D start-ups. None of the organizations mentioned the importance of proximity in relation to 'presence of knowledge'. The organization did mention that 'presence of knowledge' is very important for R&D start-ups. Some concluded the 'presence of knowledge' to be the main importance for a R&D start-up.

Organization B replied that besides the 'presence of knowledge' short lines of communication is what makes Groningen University distinctive and interesting for starting ventures. Organization C mentioned that knowledge is important as long as you can attain it cheap and apply it in a creative manner. Organization B mentioned that companies can be linked from the market to the knowledge institute. Once connected, an R&D start-up can emerge.

The response of organization B implies that the connection is more important than the proximity itself. The response from organization C also indicates that presence of knowledge (cross-overs) is more related to the costs of attaining it then to the geographical distance between the R&D start-up and the campus. Organization E replied that stimulating knowledge cross-overs for R&D start-up the Agro-Food sector is subjected to the current 'elite' image of Wageningen UR. Organization E added that the Wageningen UR campus has to find a way to overcome this elite image. This could indicate why on-campus (score 3.3) R&D start-ups rated 'presence of knowledge' so low. The gradual decrease of score table 9 from 4.4 to 4.2 and 3.5 may, therefore, be unrelated to knowledge cross-over benefits in regard to the 'presence of knowledge' since the organizations replied it is more about 'short lines' and 'getting connected first'.

4.2.2 Venture support

3.	Venture support (venture capital, rent price, personnel)
Very unimportant	1◊ 2◊ 3◊ 4◊ 5◊	Very important

4.	Do R&D start-ups mainly utilize knowledge, facilities or certain services from the region or also from other regions?
Written interviews:

Venture support	(n= 6)	(n= 10)	(n= 9)	(n= 23)	(n= 48)
(n)	On campus	0-2 km	2-5 km	>5 km	total
Very unimportant (1)	3	0	2	6	11
Not important (2)	0	1	0	2	3
Neutral (3)	0	1	2	6	9
Important (4)	3	1	2	5	11
Very important (5)	0	7	3	4	14
Average (Scale: 1 to 5)	2,5	4,4	3,4	3,0	3.3

Table 10: Average score and number of respondents (R&D start-ups) per score class (1-5) divided over four distances to the campus for location factor 'venture support.

Table 10 shows that R&D start-ups located on campus class rate location factor 'venture support' the lowest (2,5) and R&D start-ups located beyond 5 km class rate presence of knowledge the second lowest (3,0). Table 10 also shows that R&D start-ups located between 0-2 km class rate location factor 'venture support' the highest (4,4) and R&D start-ups located between 2-5 km class rate 'presence of knowledge' the second highest (3,4).

Again, just as is the case with 'presence of knowledge', it is remarkable that 'on campus' R&D start-ups give a lower score (2.5) for 'venture support' than the other proximity ranges as well. Both location factors have a very similar trend. From the proximity range '0-2 km' onward the score gradually decreases from 4.4 to 3.4 to 3.0 as expected.

Policy document analysis:

Within the documents: 'Internationalisering Provincie Gelderland: Acquisitie class & strategie en-organisatie', Wageningen Campus Strategy, Gebiedsvisie Regio FoodValley 'venture support' is one of the most recurring categories. The policy documents links proximity with venture support in the sense that the current incubation building of Startlife is located on campus. The document 'Wageningen Campus Strategy' of Breunink and Buitenhuis, 2013, contains a practiced view on how the venture support organization (Startlife) of the Wageningen campus should be practiced: *"The current StartLife organization should be used as a basis for start-up and incubator services on campus, and capital should be attracted from venture capitalists and banks."* (Breukink and Buitenhuis, 2013). This is in contrast with the finding that 'on campus' R&D start-ups give the lowest score to 'venture support' (2.5) compared to the other proximities.

The gradual decrease from 4.4 to 3.4 to 3.0 score of 'venture support' is not derived from the documents but it is mentioned that an incubation terrain on campus is beneficial in regard to supporting those R&D start-ups.

'Internationalisering provincie Gelderland' mentions that extra project managers for assisting starting companies should support these new ventures, but apparently 'on campus' R&D startups do not value this as much. The document 'Gebiedsvisie Regio FoodValley' mentions that venture support is delivered in the form of collaboration between R&D start-ups. Interviewed R&D start-ups replied that collaboration between start-ups is barely occurring, there leaving a question mark on what 'venture support' entails. 'Wageningen campus strategy: Gateway to smart food in a green world' The documents do not explicitly mention in what shape 'venture support' should be applied although the category is frequently mentioned.

Face-to-face interview: R&D start-ups:

Start-up B (on campus) replied by saying that they wished there was more business support, because they want to scale their business. The business support courses in Wageningen are very basic compared to other support courses in the Netherlands. Start-up B replied they had found proper venture support in Utrecht instead. According to start-up B; support organizations in Utrecht have more advanced courses and advisories that can aid their start-up in keeping its business viable in the long term. This finding backs up that venture support 'on campus' is lacking. Start-up D (0-2 km) would like to see more initiatives that connect the smaller ventures with their customers. Start-up D adds that these initiatives do not necessarily have to be in the same region or attracting customers from that region only. Start-up E (>5 km) is content with the current situation, since they have found support in Leiden, but 'it would be nice' if the same venture support was available on the Wageningen UR campus. Start-up E and F also were relatively independent from the start. The responses from start-up D and E do not necessarily explain the gradual decrease in the score over the proximities but do point out that there is a difference in demand in regard to 'venture support'. The 2.5 from score 'on campus' R&D start-ups is very remarkable. Start-up B clarifies that the quality of the incubation terrain is insufficient and that the R&D start-up has therefore found it elsewhere, this may be a reason for the low score.

Face-to-face interview: Policymakers/larger companies:

Organizations were also asked to what extent the R&D start-ups are generally supported on a campus and if the campus support is meeting the demand of R&D start-ups and whether something could be improved.
Organization D mentioned that the need of venture support depends on the type of start-up. R&D start-ups can stay in the 'proof of principle' phase for a long time. Once this phase is surpassed, their new challenge is (1) to attain financing and (2) to run a business. Often, 'very technical' start-ups are not suited to cope with entrepreneurial challenges.
In regard to the gradual decrease of the score from 4.4 to 3.4 to 3.0 the organizations only stated the importance of venture support for R&D start-ups. Organization E replied that (venture) support is mainly important for R&D start-ups are in need of knowledge. Organization A replied that entrepreneurship is stimulated when many start-ups come together (preferably mixed with large companies). Good settlement spots for starting ventures can for instance be city centers or university campuses (and preferably a campus that is connected to a large economic cluster). A good example is Bio-Science Park Leiden, where start-ups can be supported in various phases of the venture. Organization E replied, in the end, that the level of innovation determines the value of the R&D start-up and the demand for support.

4.2.3 Use of facilities

Questions:

1.   Use of facilities on campus (Lab, IT, restaurant)
Very unimportant   1◊ 2◊ 3◊ 4◊ 5◊   Very important

2.   Do R&D start-ups mainly utilize knowledge, facilities or certain services from the region or also from other regions?
Written interviews:

Use of facilities	(n= 6)	(n= 10)	(n= 9)	(n= 23)	(n= 48)
(n)	**On campus**	**0-2 km**	**2-5 km**	**>5 km**	**total**

Very unimportant (1)	0	3	0	8	11
Not important (2)	1	0	4	5	10
Neutral (3)	3	1	1	3	8
Important (4)	0	3	0	4	7
Very important (5)	2	3	4	3	12
Average (Scale: 1 to 5)	3,5	3,3	3,4	3,5	3.4

Table 11: Average score and number of respondents (R&D start-ups) per score class (1-5) divided over four distances to the campus for location factor 'use of facilities'.

Table 11 shows that R&D start-ups located between 0-2 km class rate location factor 'Use of facilities' the lowest (3,3) and R&D start-ups located between 2-5 km class rate 'use of facilities' the second lowest (3,4). Table 17 also shows that R&D start-ups located on campus and > 5 km class rate location factor 'use of facilities' the highest (3,5).
The results from table 11 show that the overall scores are almost constant per proximity.

Policy document analysis:

The policy documents mention little about supporting facilities, but do mention that it is a necessary asset. The constant score over the proximities is not clarified/explained by these policy documents. The category 'use of facilities' is the third most mentioned categories. The article 'Gebiedsvisie Regio FoodValley' of Knaap, 2013 states that: "…The campus and the city of Wageningen needs good access to hotel facilities and congress facilities in the direct surroundings…". The article of Wageningen Campus Strategy states: "…ensuring outstanding research facilities and equipment…" and "facilities are open for external users" (Breukink and Buitenhuis, 2013). The

Face-to-face interview: R&D start-ups:

The start-ups were asked if the R&D start-ups use knowledge transfer, facilities or any other services in a particular. Start-up F (2-5 km) replied that the initial expensive of climate-based research are high and that it is uncertain for R&D start-ups whether they can use facilities of larger companies or research institutes on demand. The incentive threshold is too high for R&D start-ups to take the next step in turning an idea into a business.

Start-up C (on campus) mentioned that the use-and potential of facilities of the campus became more apparent when they located themselves at their current location. R&D start-up A and C (on campus) replied that they could have used potential services of the university once, but their access- or presence of those location factors were lacking (e.g. business support or affordable library access). Start-up G replied that it depends on how technical the R&D start-up is. A very technical and production based (more advanced) R&D start-up (like start-up G for instance) prefers the presence of a laboratory.

The responses from the R&D start-ups support may support the constant score (+-3.4) in the sense that access to facilities is unclear or not connected to proximity but more connected to the R&D start-ups phase and technical orientation. This finding is further elaborated in chapter 6. 'Discussion', where R&D start-up characteristics, proximity and location factor scores are connected and evaluated.

Face-to-face interview: organizations:

Organizations A, C, D and F replied and specifically mentioned the connection between R&D start-ups and the use of facilities on campus. Organization A replied that it depends on the stage and the nature of the R&D start-up. If a R&D start-up is in the innovation stage, then they are more concerned with researching. In most cases, start-ups are more concerned with running a business and a research orientated environment may inhibit the business potential of start-ups. The focus should be on facilitating entrepreneurship, more than facilitating research for most R&D start-ups. Den Bosch and Amsterdam campuses are more ahead in this aspect compared to the Wageningen UR campus and other campuses. Organization A added that use of facilities is easily acquired in others regions, unless the R&D start-up needs to use laboratories. The laboratories often need to be situated nearby the R&D start-up for convenience.

Organization B replied that there are possibilities for R&D start-ups to cooperate in shared allocated buildings. Organization C replied that R&D start-ups located close knowledge institute or a large company do so mainly because for use of their facilities. Often the use of these facilities is a continues process for these R&D start-ups. This is in contrast with the constant 3.4 score from table 11, because this should mean that R&D start-ups located closer to the facility rate the 'use of facilities' location factor higher. Organization D replied that some start-ups need to use expensive equipment for research. In case the R&D start-ups are not dependent on the use of facilities, it is more important for R&D start-ups to be located close to each other. Organization F replied that facilities on the Wageningen campus are too specialized (only food and biotech equipment) and limited in quantity/availability. The university lacks equipment for other specialized work fields. These results indicate the importance of the use of facilities while organization B mentions the importance of proximity of these facilities (especially very technical R&D start-ups) although this in contrast with the constant 3.4 score findings of table 11.

4.2.4 Vicinity (labor) market

Vicinity of customers-and suppliers

Questions:

7. Vicinity of customers and suppliers (contract, control)

Very unimportant   1◊ 2◊ 3◊ 4◊ 5◊   Very important

13. Where is your market mainly located?

◊ Local ◊ Regional ◊ International ◊ Other…

Written interviews:

Main location of market	international	regional	Local	Other…
(n)	36	9	1	2

Table 12: Number of R&D start-ups (n) per main market location (international, regional, local, other)

Table 12 shows the main market location of the responding R&D start-ups. Most (n = 36) R&D start-ups have their market located internationally. The minority of R&D start-ups have their main market located regionally (n = 9) and locally (n = 1) and other (n = 2). Other entail either national, or a combination of one of the other four market locations.

Vicinity of customers-and suppliers	(n= 6)	(n= 10)	(n= 9)	(n= 23)	(n= 48)
(n)	On campus	0-2 km	2-5 km	>5 km	total
Very unimportant (1)	0	0	0	7	**7**
Not important (2)	0	2	5	3	**10**
Neutral (3)	0	2	3	7	**12**
Important (4)	2	3	1	5	**11**
Very important (5)	4	2	0	1	**7**
Average (Scale: 1 to 5)	4,7	3,6	2,6	2,6	3.1

Table 13: Average score and number of respondents (R&D start-ups) per score class (1-5) divided over four distances to the campus for location factor 'vicinity of customers and suppliers'.

Table 13 shows that R&D start-ups located between 2-5 km class rate location factor 'Vicinity of customers and suppliers' the lowest (2,6) together with R&D start-ups located above 5 km class rate 'Vicinity of customers and suppliers' similarly low (2,6). Table 20 also shows that R&D start-ups located on campus (4,7) and 0-2 km (3,6) class rate location factor 'use of facilities' the highest. A remarkable observation is that 'on campus' (score 4.7) R&D start-ups rate vicinity of customer/suppliers so high. The gradual decrease from 4.7 to 3.6 to 2.6 and 2.6 is as expected.

Policy document analysis:

The document about the FoodValley region, 'Gebiedsvisie regio FoodValley' focuses on the importance of mainly having specialized companies, but to accept other types of businesses as well. 'Proximity of (labor) market' is the second most recurring category in this document. The article of Knaap expresses proximity of labor market as: "…Companies locate their business in regions where there is talent…" (Knaap, 2013). "…First of all we want to facilitate businesses by stimulating cooperation between knowledge institutes and entrepreneurs…" (Knaap, 2013). These policy document results do not explain why R&D start-ups 'on campus' rate this location factor so high (4.7). The gradual decrease is also not explained and the lower score than the previously treated location factors is still open for interpretation.

Face-to-face interview: R&D start-ups:

R&D start-ups responded to the 'presence of the market' and 'presence of highly educated personnel' in a generalized way, using both terms mixed up. The emphasis of the responses were mostly focused on highly educated personal, therefore the responses from R&D start-ups in the face-to-face interviews are depicted in the section below 'Presence of highly educated personnel' below.

Face-to-face interview: organizations:

Organizations did not specifically mention benefits for R&D start-ups in regard to 'vicinity of customers and suppliers'. This could indicate that they do not consider this an important location factor for R&D start-ups compared to other location factors investigated during this research. The

4.7 score 'on campus' is therefore a very remarkable observation that remains unexplained from both the R&D start-ups as the organization point of view.

Presence of highly educated personnel

Questions:

9. Presence of highly educated personnel (quality, choice and price)

Very unimportant   1◊ 2◊ 3◊ 4◊ 5◊   Very important

8. Does potentially attracting future employees from the region/campus play a role for start-ups situating in/around that region/campus?

Written interviews:

Presence of highly educated personnel	(n= 6)	(n= 10)	(n= 9)	(n= 23)	(n= 48)
(n)	On campus	0-2 km	2-5 km	>5 km	total
Very unimportant (1)	0	0	0	5	**5**
Not important (2)	0	0	0	3	**3**
Neutral (3)	4	1	2	4	**11**
Important (4)	0	3	3	6	**12**
Very important (5)	2	6	4	5	**17**
Average (Scale: 1 to 5)	3,7	4,5	4,2	3,1	3,7

Table 14: Average score and number of respondents (R&D start-ups) per score class (1-5) divided over four distances to the campus for location factor 'Presence of highly educated personnel'.

Table 14 shows that the expected decrease from 4.5 to 4.2 to 3.1 which supports the importance of proximity on valuing this campus location factor. Interestingly, 'on campus' R&D start-ups value the 'presence of highly educated personnel' lower than the other proximities (3.7).

Policy document analysis:

The provincial document 'Internationalisering provincie Gelderland' states *"…The focus of the province is attracting foreign investors, new companies and starters..."* (ARCUsplus, 2013). The article of Breunink and Buitenhuis, 2013 contains a recurring combination of 'highly educated personnel' and references to 'international/pluralistic' nature of that workforce. The following sentence clearly expressed that *"highly educated, international and diverse labor force (students and employees) are strong assets of the campus."* (Breukink and Buitenhuis, 2013). The article of FoodValley (2014) 'Op weg naar een Strategische Agenda FoodValley 2015-2019' addresses that *"High priority is given by larger companies to invest in the living climate so the region is assured of sufficient knowledge workers."* (FoodValley, 2014). These documents state the importance of 'vicinity

of highly educated personnel, though the lower 3.7 score 'on campus' is not directly explained throughout these documents.

Face-to-face interview: R&D start-ups:

'Vicinity of high educated personnel' became more apparent when they located themselves at their current location according to start-up C (on campus). Start-up C states that specialized personnel (hired) does not necessarily only have to come from the Food Valley region. Half of the R&D start-ups replied that they potentially would like to attract employees from the region and the other half replied that this does not necessarily have to be from only this region. This finding supports the lower score 3.7 'on campus' compared to the other proximity ranges. Start-up G (>5 km) says that "employees from this region are a great asset, because of their experience and level of education". On the contrary, Start-up B states that they want to attract employees from all over the world because that proved to be vital for its current situation. This support the lowest score of 3.1 for the 'on campus' and > 5 km proximity range. Start-up B sees the potential of having employees from multiple backgrounds within one organization. Start-up A is hoping to have voluntary students helping him out with his occupations one day. Their assistance would then be rewarded in the form of an educational project/experience. This means that those employees do not necessarily have to be highly educated to assist 'on campus' R&D start-ups, but can also be pre-graduates. Start-up A (on campus) had worked together with faculties and student project groups in order to realize his fertilizing project and is running on a limited budget provided by sponsors.

Face-to-face interview: organizations:

The organizations generally replied that attracting future (highly educated) employees is also an argument for R&D start-ups to situate in the vicinity the campus, but did not explicitly emphasize the importance compared to other location factors. Organization A replied that it is part of their motivation, but did not support their response with any argumentation. Organization A added that it is important to connect all knowledge layers (MBO, HBO, University) because, in return, this attracts other companies to the region. Organization A added that Wageningen still needs to grow on every of these levels. Organization B said 'highly educated personnel' is mainly interesting for larger companies and less interesting for R&D start-ups. Organization C replied that 'vicinity of highly educated personnel' is not a motivation for R&D start-ups to situate on campus, these R&D start-ups are more concerned with surviving, i.e. whether their business will still exist in two years. Organization E replied by saying that it depends on the nature of the start-up. R&D start-ups could retrieve their personal (just like their knowledge) from outside the region as well. Organization F and G replied by saying that they do not think R&D start-ups are occupied with this motive and (again) this is more relevant for larger companies instead.

4.2.5 Diversity

Diversity of lively activities
Questions:

10. Diversity of 'lively' activities in the vicinity of the company (shops, restaurants, cafés)

Very unimportant   1◊ 2◊ 3◊ 4◊ 5◊   Very important

11. Do you prefer to see specialized companies separated from other companies?

12. What impact do you think the construction of several large companies, start-ups and shops close to your company have on the company's performance? To what extent does replacing of open spaces play a role for start-ups?

Written interview:

Diversity of lively activities	(n= 6)	(n= 10)	(n= 9)	(n= 23)	(n= 48)
(n)	On campus	0-2 km	2-5 km	>5 km	total
Very unimportant (1)	0	0	1	9	10
Not important (2)	0	1	2	2	5
Neutral (3)	5	2	3	5	15
Important (4)	1	5	2	4	12
Very important (5)	0	2	1	3	6
Average (Scale: 1 to 5)	3,2	3,8	3,0	2,5	3,0

Table 15: Average score and number of respondents (R&D start-ups) per score class (1-5) divided over four distances to the campus for location factor 'Diversity of lively activities'.

Table 15 shows a 'gradual' decrease over the proximity ranges from 3.2 to 3.0 to 2.5 as expected. What is noteworthy is that the score 3.8 at 0-2 km is very high compared to the other proximity ranges.

Policy document analysis:

The second most recurring categories in the document about the FoodValley region, 'Gebiedsvisie regio is 'diversity of activities'. The article states: "There needs to be the possibility to provide side activities for companies coming to the region" (Knaap, 2013, p. 19). In the other policy documents 'diversity of activities is much less recurring. The document of Knaap, 2013 also states: "network activities need to be connected" (Knaap, 2013, p. 29). The document 'Inspiratiebeeld regio Food Valley' of Communicatie, 2014 states: "Existing business activities should expand to enhance technological collaboration." (Communicatie, 2014, p.11). The document also states: "entrepreneurs want to talk with citizens, therefore a panel, website and diverse activities for bringing these groups should emerge." (Communicatie, 2014, p. 33). The document 'Internationalisering provincie Gelderland' of Arcusplus, 2013 states: "extra (business) activities in an area should be coupled with branding" (Arcusplus, 2013, p. 8). The document 'Wageningen Campus Strategy' of Breukink and Buitenshuis, 2013 states: "…connecting external organisations on development related activities…" (Breukink and Buitenshuis, 2013, p. 4).
These results show that there is a desire to connect knowledge and business sector through related and unrelated activities preferably to stimulate the branding perspective of the region. This finding does not explain the spike of 3.8 in table 15 nor the gradual decrease of table from 3.2 to 3.0 to 2.5.

Face-to-face interview: R&D start-ups:

Start-up G (> 5km) replied that the diversity of activities may harm the green image of the environment. Start-up D (0-2 km) and F (2-5 km) reply that a diversity of ventures can be beneficial for them although Start-up D, like Start-up G, mentions that it the developments regarding the

replacement of open space and increased density of diverse activities have to be controlled, hence "respecting" the current landscape of the campus. The spike score 3.8 at 0-2 km of table 24 could therefore mean that more diversity to a certain extent is an important location factor due to the added benefits it brings which do weigh up against the costs of losing other pre-dominant location factors of the campus. A possibility is that it brings more liveliness to the campus while those mentioned distractions 'on campus' absent at the 0-2 km R&D start-ups. The R&D start-ups did not mention anything about the relation between 'diversity of activities' and proximity although R&D start-up G (> 5 km) mentioned its negative view on more 'diversity of activities' on campus.

Face-to-face interview: organizations:

Organization A, B, D, E replied that diversity of lively activities on campus is neither important nor unimportant for R&D start-ups, mainly because they not directly mention it. Organization C and G replied that diversity of lively activities is a good property of a campus. Organization C mentioned that start-ups situated near the campus and around other start-ups have a higher chance of interaction with one another. The face-to-face interviews showed that interaction between R&D start-ups on a professional level is barely the case. Organization C added that a diversity of activities makes the campus more attractive for R&D start-ups to be situated there. Organization F answered question 12 of the face-to-face interview of appendix 2 from a regional/campus perspective and added that the trend of campuses to diversity both its educational tracks-and activities on campus is a good development for the region and the campus itself, because it makes the region more robust. Again these responses do not explain the spike of 3.8 of table 27, and leaves this finding open for interpretation. These findings do explain how increased activities may stimulate interaction and therefore suiting R&D start-ups that are located closer to the activities on campus. R&D start-ups located further away still benefits (indirectly) from this activities but not as much according to the responses from the organizations (due to the effects of regional robustness, for instance).

Meeting spots/opportunities

Questions:

13. Meeting opportunities on campus (events, meeting spots)

Very unimportant   1◊ 2◊ 3◊ 4◊ 5◊   Very important

Written interview:

Meeting spots/opportunities	(n= 6)	(n= 10)	(n= 9)	(n= 23)	(n= 48)
(n)	**On campus**	**0-2 km**	**2-5 km**	**>5 km**	**total**
Very unimportant (1)	0	0	0	7	**7**
Not important (2)	0	1	0	4	**5**
Neutral (3)	0	3	6	4	**13**
Important (4)	3	0	3	5	**11**
Very important (5)	3	6	0	3	**12**
Average (Scale: 1 to 5)	**4,5**	**4,1**	**3,3**	**2,6**	**3.3**

Table 16 shows that the proximity ranges do gradually decrease from 4.5 to 4.1 to 3.3 to 2.6. What is remarkable is that this location factor is rated relatively high at 'on campus' and '0-2 km' proximity.

Policy document analysis:

The paragraph addresses the findings of the campus itself. The document 'Wageningen campus strategy' was analyzed. The category 'meeting spots' was the second most recurring category in this document. The article of Breukink and Buitenhuis, 2013, exemplifies the lack of meeting opportunities on campus as one of its weaknesses compared to other campuses. *"The support and infrastructure for start-ups requires further professionalization and the existing campus traffic plan and meeting areas are insufficient for good informal meeting."* (Breukink and Buitenhuis, 2013, p. 9). The document 'op weg naar een strategische agenda' of FoodValley, 2014 states: *"more meeting opportunities for business and knowledge networks should emerge (e.g. inspiration days)"* (FoodValley, 2014, p. 15). The other documents did not explicitly state anything particular about meeting spots as the document of FoodValley, 2014 did. This document is clearly focused on campus. This may therefore explain why R&D start-ups 'on campus' and '0-2 km' rated this location factor so high (4.5 and 4.1), see table 16. Therefore it also support why there is a gradual decrease in score in the sequential proximity ranges.

Face-to-face interview: R&D start-ups:

Most start-ups did not go further into the added value of meeting spots/opportunities, as they see it as part of diversity of activities. The overall opinion regarding these location factors is that the added value of diversity of activities can either be good or bad, depending on the start-up. Start-up B (on campus) replies that a diversity of activities adds to the amount of distraction, hence distraction is not good for business. Start-up C (on campus) thinks this question is difficult to answer because at first glance the added value of meeting spots-and other activities would not be vital for the survival of the business. Start-up B adds that now that they are located on campus and experience the interaction on these meeting spots they see the potential.
These results do not represent the high score of both the 'on campus' as the '0-2 km' R&D start-ups, because this score is relatively high while 'on campus' respond mildly to this location factor and R&D start-up D (0-2 km) did not mention this location factor at all.

Face-to-face interview: organizations:

The Organizations were asked which location factors have become more important for starting ventures over time and, on the contrary, which location actors have become less important for R&D start-ups. Organization A and B replied that interaction opportunities-and places have become more important over time. Examples of interaction opportunities-and places are; guest colleges, meetings and even flex working places. Organization D replied that good-and affordable hospitality (e.g. bars, lounges), common meeting place and a (personal) customizable working place have become important. Campus managers should have a good feeling for what fits with a starting venture as well. Again organization A referred to the importance of having a distinctive epicenter on campus. Besides the epicenter's benefit of standing out and characterizing the campus, it offers room for meeting opportunities/spots as well. Organization A adds; centralized meeting spots will stimulate interaction.
Increased importance (and popularity) of meeting spots/opportunities may indicate why the scores of table 16: 4.5 and 4.1 'on campus' and in the '0-2 km' range are so high.

4.2.6 Open green space

Policy document analysis:

14. The green environment and space between buildings

Very unimportant   1◊ 2◊ 3◊ 4◊ 5◊   Very important

12.   What impact do you think the construction of several large companies, start-ups and shops close to your company have on the company's performance? To what extent does replacing of open spaces play a role for start-ups?
Written interview:

Open green space	(n= 6)	(n= 10)	(n= 9)	(n= 23)	(n= 48)
(n)	On campus	0-2 km	2-5 km	>5 km	total
Very unimportant (1)	0	1	3	6	10
Not important (2)	0	2	0	4	6
Neutral (3)	3	4	4	6	17
Important (4)	3	3	1	4	11
Very important (5)	0	0	1	3	4
Average (Scale: 1 to 5)	3,5	2,9	2,7	2,7	2.8

Table 17: Average score and number of respondents (R&D start-ups) per score class (1-5) divided over four distances to the campus for location factor 'open green space'.

Table 17 shows a gradual expected decrease from 3.5 to 2.9 to 2.7 to 2.7. This correlates to with the expected decrease of experienced benefits when your business is located further away from the campus.

Policy document analysis:

Part of the second most recurring categories in the document about the FoodValley region, 'Gebiedsvisie regio is 'green open space'. The article of Breukink and Buitenhuis, 2013 summarizes the benefits of Wageningen UR campus. One of the points made is 'the open setting' of Wageningen. This characteristic is depicted din the sentence; *"…15,000 people employed by different organizations work and study every day in the green and open setting of Wageningen Campus."* (Breukink and Buitenhuis, 2013, p. 23). Other documents do mention the benefits of connecting the natural outside regions with the Agro Food sector, but those remarks were not related to the campus itself. The finding of Breukink and Buitenhuis, 2013 shows that the open space is appreciated as an appealing landscape setting to be in.

Face-to-face interview: R&D start-ups:

The start-ups responses were mixed. Some responded in the sense that the green image should be taken into account when replacing green open spaces (see appendix 8). Generally more diverse and

lively activities are a good development through the eyes of the R&D start-ups. Start-up A (on campus) replied that a green open environment is already too artificial according to the R&D start-ups taste. It seems to represent a very neat and business like appearance. Start-up A worries about excluding businesses and start-ups that do not necessarily feel represented by the environment. Start-up C (on campus) does not mind the green environment being replaced. Start-up C sees more benefits in a diverse set of activities than saving green space. Start-up D (0-2 km), E (> 5km), and F (2-5 km) believe that the green environment is part of the green image of Wageningen. They respond that this image should be preserved (see appendix 8). The other start-ups did not respond directly to the 'replacing of green space' part, but stressed other self-interest related aspects of the campus. Start-up G is not located on campus and replied to this question by stressing the importance of creating awareness about the added value of their technology. This answer had little to do with the question. The responses were divergent, but indicate that besides the image supporting effect it is more beneficial for R&D start-ups close to the campus to directly experience this aspect of the campus landscape.

Face-to-face interview: organizations:

Organization A replied that 'green' is important, but a beautiful building that allows room for customization and interact with one another is more favorable. Organization A added that the surrounding landscape should still keep its qualities (green character) regardless. Organization B be did not go further into the replacement of open green spaces or into the presence of diversity of activities on campus but stated that another university campus has two campus spots with diverging different characteristics. One with open green spaces and less diversity of activities but good housing opportunities for start-ups and the other campus is located in the city center where density and diversity are prevailing characteristics. Organization C replied that start-ups in dense areas can still enjoy roof gardens for instance and are not adversely affected by an increase of open space replacement. Organization C added that even cities have their own 'quite spots' for those who seek it. Organization E replied that the green image belongs to Wageningen and is a quality that attracts start-ups as well. Organization E added that from a business perspective a more diverse and dense campus is better for attracting "a larger audience". Organization F did not mention anything about the green open spaces, but stressed the importance of having diversity, as was mentioned in section '4.2.5 Diversity of lively activities'.
These responses indicate that open green space is not that important unless certain 'valuable' open space features are lost. These lost features may therefore directly influence the environment of the campus and its image.

Vicinity of a large related company

Questions:

15. Large Agro-Food company in the proximity (related to your company)

Very unimportant   1◊ 2◊ 3◊ 4◊ 5◊   Very important

12.   What impact do you think the construction of several large companies, start-ups and shops close to your company have on the company's performance? To what extent does replacing of open spaces play a role for start-ups?

Written interview:

Vicinity of a large related company	(n= 6)	(n= 10)	(n= 9)	(n= 23)	(n= 48)
(n)	**On campus**	**0-2 km**	**2-5 km**	**>5 km**	**total**
Very unimportant (1)	0	3	3	8	**14**
Not important (2)	0	3	0	4	**7**
Neutral (3)	3	3	5	8	**19**
Important (4)	3	1	0	3	**7**
Very important (5)	0	0	1	0	**1**
Average (Scale: 1 to 5)	**3,5**	**2,2**	**2,6**	**2,3**	**2.0**

Table 18: Average score and number of respondents (R&D start-ups) per score class (1-5) divided over four distances to the campus for location factor 'Vicinity of a large company'.

Table 18 does not show a gradual expected decrease from the closest to the furthest proximity range but two spikes at 'on campus' 3.5 and a slight spike at the 2-5 km range.

Policy document analysis:

In general, the articles do not mention anything specifically about whether businesses should be located geographically close to one another. The article of Knaap, 2013 does mention that *"The region would like to be a wake for large 'top' companies by strengthening a diverse economy."* (Knaap, 2013, p. 6) It is not specifically defined what diversity entails. The article also addresses that *"We want to directly connect knowledge with business development in the region"* (Knaap, 2013, p. 12). The article of FoodValley (2014) 'Op weg naar een Strategische Agenda FoodValley 2015-2019' mentioned that local businesses and knowledge institutes should transfer knowledge locally, but there was no specific reference to whether start-ups and businesses should also physically be located to each other.
These policy document results do promise that there could be synergy between (large companies and R&D start-ups.

Face-to-face interview: R&D start-ups:

When the start-ups were asked if they see any added value in locating their business in the vicinity of a larger related company, the responses were mixed. Start-up B (on campus) and F (2-5 km) replied that an electronic or engineering technical company could be of use. Start-up A (on campus) again stresses the suppression of creativity, when a larger companies may dominate the start-up incubation program. Start-up C (on campus), D (0-2 km), E (>5 km) and G (>5 km) would rather not have a large company in the vicinity or they do not have an opinion about it.
It seems that R&D start-ups may see potential in close proximity of a larger company but have not experienced it yet directly, while others do see more negative than positive effects regardless of the proximity range in which the R&D start-up is situated.

Face-to-face interview: organizations:

The Organizations were asked if the vicinity of a larger company would play a role in the functioning of the R&D start-ups. Organization B replied that in Groningen, there are two campuses. One in the center of Groningen (Healthy Aging) and one on the outskirts (e.g. Innolab). Both campuses have different characteristics for businesses the outskirt has more larger companies for instance and attract different ypes of R&D start-ups. Organization C replied that universities also want young entrepreneurs on campus as this radiates dynamism. The Organizations stated that they do not see any necessity in locating a R&D start-up next to larger companies (co-location). They do see added value in having a lively surrounding (in the form of restaurants and such), supporting ventures like IT companies are welcomed by Organization A.
No clear examples of successful interactions have been mentioned by the organizations. The results seem to be based on the perspective on the role of larger companies instead of on their actual role in supporting R&D start-ups on campus. Also, the spikes 'on campus' and '2-5 km' may therefore be based on the R&D start-ups perception on larger companies.

4.3 Ranking of the campus' main category

Ranking: 'Knowledge hub' production environment	'Presence of knowledge'
1	Set-up & Product & service development (4,4)
2	Service provision (4,3)
3	Average + good connection (4,1)
4	Beginning of marketing (4,0)
5	International (4,0)
6	Old market + new tech (3,9)
7	new market + mix & old tech (3,9)
8	Production (3,9)
9	Barely a connection (3,8)
10	Selling product/service (3,7)
11	Not international (3,3)

Table 19: Ranking of the knowledge hub campus environment based on rating of 'presence of knowledge' category. The ranking is divided over the various start-up classes.

The classification groups ranking of the knowledge hub campus environment based on rating the 'presence of knowledge' category. The ranking is divided over the various start-up classes, see table 32. The table for instance gives insight in the extent to which some R&D start-ups are more connected to the main characteristic of the Wageningen UR campus.

The 'knowledge hub' production environment received the highest score among the classification groups; 'Set-up, product & service development' (4,4), 'Service provision' (4,3), and 'Average + good connection' (4,1). The classification groups 'Barely a connection' (3,8), Selling product/service (3,7) and 'Not international' (3,3) rated 'presence of knowledge' the lowest among all researched classification groups. These results indicate to what extent these classification groups are connected to the main specific location factor of Wageningen UR campus as a Knowledge hub environment.

4.4 Summary

The core characteristic of the Knowledge Hub campus: 'presence of knowledge', is most valuated of all location factors. At the same time, the image of the campus is connected and much referred to when investigated the importance of the location factors, including the presence of knowledge. The various proximity ranges follow an expected decline of the valuation of location factors by R&D start-ups. The use of facilities is an exception and is not connected to geographical proximity.

The 'on campus' and '> 5km' proximity range contain deviating R&D start-ups and score characteristics that may be connected to each other, see 'discussion' chapter 6 for an elaboration. There is a demand for low-key and affordable interaction on a local scale with stakeholders 'on campus' but a greater demand for international opportunities (which coincides with the image of Wageningen UR campus).

Some R&D start-ups mentioned disappointment in regard to the initial expectation of use of certain location factors compared to the actual use of these location actors. On the contrary, a lack of use of venture support and facilities/knowledge is not always a problem, because this is available in other regions, outside the campus.

5. Conclusion

The main research question in this thesis is: How important is the proximity of the campus for R&D start-ups in the Agro-Food sector? This research has focused on two elements: 1) how R&D start-ups can be classified 2) and how classification and proximity affect preferences of R&D start-ups to the campus. The answer to the main research question is that proximity is important in the location choice for R&D start-ups in regard to the image of Wageningen UR campus and highly educated personnel (especially from the face-to-face interviews). The result shows that the closer the R&D start-up is located to the campus, the higher the tendency to prefer agglomerate specific location factors. The overall average scores of all investigated R&D start-ups show that location factors that characterize the 'Knowledge hub' are most preferred. Some proximity ranges do have expectations which are treated within this chapter.

In other words: R&D start-ups investigated in this thesis located on-or-near the Wageningen UR campus rate 'Knowledge hub related characteristic location factors' higher that R&D start-ups located further from the campus. The sections treated in this chapter further elaborate on this main conclusion.

5.1 Research execution recap

This thesis set out to investigate how important proximity of the campus is for R&D start-ups in the Agro-Food sector. Within this thesis, Wageningen UR, as the only mature campus in the Agro Food sector of the Netherlands, was selected for the investigation. 48 R&D start-ups were interviewed in a written format and another 7 R&D start-ups and 6 organizations (4 campus investors/policymakers and 2 larger companies) were interviewed in a face-to-face format (chapter 3). Besides the interviews, a document analysis on the policy documents was done (chapter 3). The face-to-face interviews were executed after the results from the written interviews were completed. The selected R&D start-ups for this these were divided into four proximity ranges (on campus, 0-2 km, 2-5 km and > 5 km). The combined face-to-face interview and analyses of the policy documents results are used to interpret and understand the results from the written interviews besides the use of scientific literature.

5.2 Proximity as luxury but not as necessity

This section treats the main findings from this thesis per research question, per paragraph. In the final paragraph, the main research question is answered.

The main research question: "Does the proximity to the campus influence the location choice of R&D start-ups?" can, therefore, be answered according to this thesis' findings. Different proximities to the campus are of influence on the R&D start-ups location choice. The type of company and the circumstances connected to the proximity ranges have an influence on the choice of location. It is clear that from this thesis' results that the closer R&D start-ups are located to the campus, the more campus specific location factors are valued. A noteworthy observation is that R&D start-ups located on campus do value location factors higher than others, but state in the face-to-face interviews that for instance 'presence of knowledge' 'venture support' and 'use of facilities' is not well supported by the Wageningen UR campus. These R&D start-ups, often located in incubation terrain, have to find the expected benefits embedded in those needed location factors elsewhere. For R&D start-ups around the Wageningen UR campus, other regions, like Leiden Bio-Science Park (LU), Delft University (TU), Utrecht University (UU) are referred to by both organizations and by R&D start-ups when it

comes to additional 'use of facilities' and 'venture support' (both financially as in knowledge provision). Considering this finding, it indicates that, besides not having those location factors present/accessible on campus, R&D start-ups can still keep the business functioning accordingly. These R&D start-ups state that the image of the Wageningen UR campus is very important for them and that R&D start-ups located 'on campus' want to be associated with that image. When these R&D start-ups were asked whether certain changes on the Wageningen UR campus are for this moment of importance for the functioning of their business, it is multiply stated that 'it could/would be nice' as long as it does not harm the image of the campus (start-up E). So, if knowledge spillover among R&D start-ups is limited, then according to this thesis results, besides limited support and use of facilities, the image of the Wageningen UR campus becomes one of the leading argument for R&D start-ups to locate their business in that particular location on/near the campus. This means that the benefits in knowledge spillover opportunities, as one of the most portrayed arguments for R&D start-ups to locate their business on the Wageningen UR campus might be exaggerated. Which, for instance, is in contrast with the article of Dagevos, 2011 and Van Oort, 2011 which both state that 'actual knowledge spillovers play a crucial role when it comes to the actual realization of innovative products and services' (Dagevos, 2011; Van Oort, 2002).

In regard to research question 1: "What are the R&D start-ups characteristics and how can they be classified?", the R&D start-ups can be classified by the characteristics: stage and drivers, the level of independence, type of innovator, economic situation, focus and the geographical proximity of the campus to the R&D start-ups.

In this paragraph, the main findings of research question 2: "To what extent do the location factor preferences differ to R&D start-ups that are located on (1) / near (2) / or relatively far (3) from the campus?" are evaluated along the lines of the analytical framework. This thesis indicates that there is a lot of differences in location choice at different proximities (see chapter 4). The results do indicate that the location factors 'use of facilities' is barely influenced by proximity. All the other location factors are influenced by proximity to a certain extent, but some more than others. R&D start-ups located 'on campus' have a slightly different set of valued location factors than R&D start-ups located on other proximities, because they value location factors of other campus production environments higher. Also, R&D start-ups located in the > 5km and 'on campus' proximity range both rate most location factors provided by the campus lower than R&D start-ups located in the 0-2 km and 2-5 km proximity range. Various articles back this finding up in the sense that incubation areas contain different kind of R&D companies and R&D start-ups located beyond 5 km to the campus have a different perception of the Wageningen UR campus than those located closer to the Wageningen UR campus.

Most location factors follow an expected decline over the geographical proximity ranges. The findings regarding the influence of proximity are accord with the analytical framework in which 'venture support', 'labor market', and 'presence of knowledge' (specific Knowledge Hub location factors) are influenced by the geographical proximity of the campus. Within the 0-2 and 2-5 km range the R&D start-ups characteristic make-up and expected a decline over the distance is fairly similar to the other two proximity ranges and to each other. The exceptions are visible within the 'on campus' and >5 km group and for the 'use of facilities' location factor which has similar scores at all proximity ranges. At the 'on campus' R&D start-up group 'venture support' and 'presence of knowledge' (both Knowledge Hub specific) score the lowest and 'vicinity of labor market' and 'vicinity of meeting spots/opportunities' score the highest of all proximity ranges.

Also, regarding the R&D start-ups characteristics, 'on campus' and '> 5 km' R&D start-ups are differing in seven characteristics from themselves and the other two proximity ranges. These differences in R&D characteristics do show that there might be a connection between the preferences location factors of R&D start-ups of the campus of Wageningen UR and the investigated characteristics, see the discussion chapter 6. All in all, the face-to-face interviews indicate that

presence of knowledge (through image) and the 'presence of highly educated personnel' are more profound motivators to settle in close proximity to the campus, see average score of table 9 to 16 (bottom right side), section 4.2.1 to 4.2.5.

5.3 Reflection on the used methods and its limitations

This section discusses the results of the face-to-face interview and written interviews approach in regard to the case and the relevant theories and aspects.

The written interviews received 48 respondents in total; this number is already on the low side of the spectrum (19% response rate) and too low to set-up a hypothesis and significantly accept or reject it. The reason why testing a hypothesis is unnecessary for this study is because the outcome of that test, regarding a number of respondents, would turn out to be too few. Part of research question 2 is the compare each of the classified groups. Some of these groups (especially beginning of marketing n=2) had such a low amount of respondents that is difficult to draw any conclusions. Therefore, any conclusions drawn from this study should be taken lightly, though this study already provides a good indication for policymakers.

One of the expected limitations of this concept is the definition of a 'mature' campus and the impact of smaller Knowledge hubs/ agglomerates within the region. The Wageningen campus is the main Knowledge hub/campus. Companies may value other knowledge clusters, like Veenendaal and Ede as well. Therefore a reconsidered selection of R&D start-up companies located 'relatively far' from the campus has to be made. In case start-ups are located between two campuses, this variable should be taken into account (even though the campuses Veenendaal and Ede, do not meet the requirements to be 'a mature campus'). Another limitation is that some campuses provide incubation locations for R&D start-ups. These locations are often meant to support the start-ups, located in these places. Making a separate selection between these and other start-ups may provide different insights.

In regard to the written interviews, 'image of the campus' is not included (RQ2) within the written interviews because the focus of this study had changed during the research period. The added aspect 'perception' of the theory 'branding' was added at the moment when the written interviews were sent to various R&D start-ups. The added value of including 'image' later on in the research process, turned out to be a fundamental motive, because from the previous chapter 2 'Analytical framework' it became clear that expected benefits of the Wageningen UR campus turned out to be very much connected to the image of Wageningen UR campus. Within the face-to-face interviews, it also showed that presence of knowledge is more connected to the image than any of the other location factors because the respondents kept referring to the 'image' and 'knowledge' within the same sentence a lot.

Because 'image', as a location factor was left out, it strengthened other parts of the research. This showed which location factors were connected to the image of the campus. In the end, this decision became considerably valuable regarding the interpretation of the results.

Another limitation is that within the methodology it is stated that 'additional classification criteria for R&D start-ups' from the answers from face-to-face interviews with various policymakers, investors and large companies would be used to sharpen the classification criteria of R&D start-ups for the written interviews. One of the organizations stated that the criteria for R&D start-ups: 'exit against continuing strategy' and 'technical vs. entrepreneurial mindset' can also be used as classification criteria to separate the heterogeneous R&D start-up group. The 'exit against continue strategy' means that R&D start-up's eventual goal is to sell the business to investors vs. continuing to grow

after groundbreaking success. These criteria eventually were not used to distinct the data, because the written interviews were already sent out to the various respondents before the face-to-face took place.

An expected limitation is that close proximity to the campus may 'just feel right' regardless of other locations that may suit their locational preferences. Therefore any choice related to proximity may be based on other or irrational choices (bandwagon effect).The production environment that is most preferred says something about the production environments that are less preferred and the other way around (compared to the three different proximities relatively to the campus). This is difficult to directly correlate to within this thesis research (McAdam and Marlow, 2007).

Another limitation is that 'venture support' is a broad term that can be interpreted in multiple ways. Also, venture support also includes 'personnel' in the written interview, which could be conflicting with 'highly educated personnel' in the written interview.

R&D start-ups have a wide range of characteristics. It is important to select the appropriate criteria for classifying various R&D start-ups. These criteria have been selected from literature that assesses the most important spin-off/start-up classification criteria according to that literature which is bound to specific circumstances and personal conviction. Irrelevant classification criteria are unnecessary, therefore a preselection of criteria from literature is made. Which qualification criteria are used depend on policymaker opinions, literature and, in the end, selection of the author. This thesis is actually testing those classification criteria found in literature and applying its praised relevance to this case. Eventually, a number of respondents limited the extent to which these classification groups could separately draw to a certain conclusion about that group. Another limitation to the use of this concept is that there might be more relevant criteria (new criteria) that are misrepresented in literature or simply not well documented. Initial interviews with the various subject groups (policymakers, mother companies, and start-ups) might give insights in revealing the relevant 'new criteria' among start-ups. Also, various subject groups might provide irrelevant information about which criteria to select. In that case; matching responses are observed or the response regarding 'selection of classification criteria' makes sense (also based on additional literature research), these criteria can be added or the existing criteria can be removed or sharpened. Another limitation is that the selected criteria might not be as applicable for the researched start-ups as they do not represent clear distinctive groups within the total start-up population. Literature about companies and the campus refers to a different type of companies (start-ups, spin-off and 'companies' in general), this may influence the applicability of the used theories for this thesis or any other research/case.

The decision was made to add a 'mono-limited' proximity range, namely '> 5km', instead of '5-15 km' for this research, because the >5km group consisted of a considerable amount of R&D start-ups, which compared well to the quantity of R&D start-ups in other proximity ranges. For this research, it was interesting to also include R&D start-ups located farther away due to their connection to the Wageningen UR campus and the final amount of respondents from the written interviews.

6. Discussion

This chapter elaborates on the connection between concepts and theories and the results of this study. The connection between the results of the study and the theories and concepts take into account to what extent various theories overlap, diverge and/or conflict per research question. In general, the most deviating results in the location choices of R&D start-ups at each of the

demarcated proximities are R&D start-ups located 'on campus' and '>5km'.

This 'Discussion chapter' examines research question 2, since research question 1 is based on literature research and already thoroughly analyzed in section 2.1.2 'Characteristics of R&D start-ups'.

6.1 The role of R&D start-up typology per location

This section analyses whether the distinct classification properties (typology) of R&D start-ups could be related to the valuation of location factors per proximity range.

2. To what extent do the location factor preferences differ to R&D start-ups that are located on (1) / near (2) / or relatively far (3) from the campus?

On campus:

The 'on campus' proximity range shows both a very distinctive R&D characteristic make-up and has the most deviating scores compared to the other proximity ranges. The most remarkable scores of location factors are 'the lowest presence of knowledge score (3.3), 'the lowest venture support score (2.5)', 'the highest score for the vicinity of customers/ suppliers (4.7)' and 'the highest score for meeting spots/opportunities (4.5)'. In regard to the characteristics of these R&D start-ups, these R&D start-ups are mainly 'production based', 'barely have a connection with the university', all use a 'new technology' and expectedly have the highest ratio of R&D start-ups that made use of an incubation program.

This paragraph will go by each of the distinctive findings and R&D start-ups characteristics and see how those compare with literature. The lowest presence of knowledge score (3.3) and venture support score (2.5), might have a connection with the quality of staff that is provided by the incubation program. Or as the article of Wright et. al., 2004 put it: the quality of staff of the incubation program is detrimental to the entrepreneurial output of the R&D start-up. If the staff is more focused on breakthrough discoveries instead of commercialization, this greatly influences the R&D start-up's success (Wright et. al., 2004). 'On campus' proximity range has the highest ratio of R&D start-ups that use 'an incubation program'. On the other hand, the face-to-face interviews of start-up A to C suggest that venture support is attained, elsewhere, outside the region. What might be interesting for further research is to see whether if all the required level of knowledge/venture support is attainable 'on campus', this would improve the internal functioning of those R&D start-ups? The characteristic of 'on campus' R&D start-ups to what the worst connection of all proximity ranges remains strange because one would expect that connection to be better due to the geographical distance to the university. The article of Wright, et al., 2004 adds that R&D start-ups located on campus have a low level of interaction (barely a connection) with the university but that it is still a better connection than that between the university and R&D start-ups located further away (Wright et. al., 2004). These findings show a deviating result compared to the investigated literature. 'On campus' R&D start-ups are mainly 'production based' and use a 'new technology'. The article of Wright et. al., 2004 states that those R&D start-ups are debt based and have more difficulty in attracting professional management while the article of Di Gregorio, et. al., 2003 adds that 'new technology' R&D start-ups are also less interesting for venture capitalists. There seems to be a connection with the low score of 'presence of knowledge' and 'venture support' and the literature that state that attaining benefits from the campus for these location factors is generally more difficult.

0-2 and 2-5 km

Most location factors follow an expected decline over the geographical proximity ranges. Within the 0-2 and 2-5 km range the R&D start-ups characteristic make-up is fairly similar to the other two

proximity ranges and to each other. For example, as expected, the connection with the university, for instance, decreased in the proximity ranges from 'on campus' onward. All proximity ranges have a relatively similar ratio in the 'market location', where the 'international market' makes up for the largest part of the R&D start-up's market. This finding is supported by the article of Clarysse et al, 2005 which mentions that in the context of globalization, small R&D start-ups must compete with international (not just local) firms to supply the large local companies (Clarysse et al, 2005). A reason for this even division could be that the necessity of being internationally orientated is very important for their business and has little to do with their location choice. The 'type of company' make up of all the proximity ranges are also very similar. The proximity ranges consist mostly of 'independent companies' with some 'spin-offs' or 'daughter companies'. The article of Chesbrough et. al., 2006 mentions that university spin-offs exploit technological knowledge more than any other R&D start-up (due to easier formal forms of knowledge transactions) (Mustar et al., 2006; Chesbrough et. al., 2006). These thesis results are therefore not able to reveal this connection because there is no distinctive finding on this R&D start-ups characteristic. Also, the moment the company was founded/ came to the university is varying widely and some R&D start-ups speculated which year it is. This characteristic is therefore not taken into account for further analyses regarding this matter.

The 0-2 km proximity range does have the highest diversity of activities score 3.8. There are no distinctive properties of the 0-2 km range that could connect this finding with those properties. The same applies for the '2-5 km range'

<u>>5 km</u>

This proximity range contains scores of location factors that, like the 0-2 and 2-5 km proximity range, follow an expected decline. The main difference with the ' >5km' proximity range compared to the others is that the R&D characteristics of this proximity range contain more R&D start-ups that are in the 'setting-up / beginning of marketing phase', function within an 'old market' and are focused on '(product) process improvement'. In literature, it is not clearly stated anything about '(product) process improvement' R&D start-ups and the campus. In regard to the phase of the R&D start-up companies, like mentioned before, R&D start-ups that are in a later development stage have a propensity to use more of the university's resources (Laursen & Salter, 2004). On the other hand, the location factor: 'use of facilities' of the campus is rated similarly important overall proximity ranges (around 3.4). This would be expected to be less since the ratio of 'setting-up/beginning of marketing phase' is higher in this proximity range.
Since conventional knowledge sources are prime drivers and new market (and technology in the ' on campus' case) are risky for venture investors (Di Gregorio and Shane, 2003; Laursen & Salter, 2004), a lower importance score for 'venture support' in the ' >5km' range fits the picture. These R&D start-ups find it easier to acquire external funds. This location factor could also be differently interpreted since this could also include incubation program personnel. Start-up E and F (located within the '>5 km') mentioned they also were relatively independent of the start.

6.2 What is important for R&D start-ups?

This section explores to what extent the location factor are of importance to R&D start-ups and how this is related to each of the proximity ranges.

Presence of knowledge

Presence of knowledge is rated the highest according to R&D start-ups located within the 0-2 km range (score: 4.4) to the campus. Location factor 'presence of knowledge' is least preferred by R&D

start-ups 'on campus' (score: 3.3) compared to the proximities '2-5 km' (score: 4.2) and '>5 km' (score: 3.5) away from the campus. This result suggest R&D start-ups on-and relatively far away from (>5 km) the campus benefit the least from the presence of knowledge on campus. Also, the lower score of 3.3 'on campus' is an remarkable deviating observation.

Literature suggests: *"R&D start-ups located closer to the campus make more use of the facilities and the knowledge spillover opportunities than R&D start-ups located further away"* (Van Oort & Raspe, 2007, p. 12). The article of Audretsch and Lehmann depicts a similar starting point, namely: *"The results clearly show that the number of firms located close to a university is positively influenced by the knowledge capacity of this region and the knowledge output of a university"* (Audretsch and Lehmann, 2005, p. 33). The article of Batista & Mendonca, 2010 contradicts these statements by arguing that: new firms requiring minimal knowledge-based manufacturing are more likely to be started by individuals with lower entrepreneurial human capital (Baptista & Mendonça, 2010). As was mentioned before, to some R&D start-ups 'presence of knowledge' is more connected to the image of Wageningen UR campus. On the contrary to the positive effects of the presence of knowledge on campus and its image effects, the article of Chan & Lau, 2005 found that: *"Another similar perspective that emerges from our case study is that the positive effect of good public image of the campus on technology tenants is minimal…"*(Chan & Lau, 2005, p. 124).

This study's face-to-face interviews implied that image is a rather important aspect of the campus for R&D start-ups in their location choice, because it connects the right people (see section 4.2.1, section 4.2.6 and appendix 8). This thesis findings therefore, to some extent, debunk findings the article of Chan & Lau, 2005 and Van Oort & Raspe, 2007.

R&D start-ups indicate that the knowledge they need is more related to 'how to support their enterprise' then it is about acquiring Agro-Food specific knowledge, see section '4.2.1 Presence of knowledge'. This brings this paragraph to examining a 3.3 score 'on campus' for 'presence of knowledge'. It is quite difficult, with the given literature, though the face-to-face interviews indicate that R&D start-ups are not worried about 'venture support' because they can attain this elsewhere (outside the region). Besides, direct benefits of the 'presence of knowledge' through cross-overs is not as self-evident as the policy documents of the campus suggest (see face-to-face interview R&D start-ups: R&D start-up B). The finding of the article of Groenigen, 2013 which states that '*smaller companies are especially depending on fast and affordable knowledge transfer'. This indicates that* R&D start-ups located 'on campus' may not be as much subjected to the geographical proximity of the source of the 'knowledge-spillovers', in this case.

The 'on campus typology' of these R&D start-ups which are: 'production based', have a 'bad connection with the university' and all use a 'new technology' compared to the R&D start-ups located at other proximities may be associated with the finding that knowledge is attained outside the region.

Face-to-face interviews with R&D start-up A, B, C show that 'on campus' R&D start-ups are situated on this location mainly to be guided in running their enterprise or for financial support. Those R&D start-ups are barely interested in Agro-food specific knowledge spill-over effects of the campus. The importance of Agro-Food specific knowledge spill-over effects at other proximities are also not related to Agro Food specific knowledge spill-overs, but for other reasons. Though, not being located 'on campus' but within a 5 km range from the campus makes the 'presence of knowledge' a more important location factor.

R&D start-ups located further away, do not mention the need for venture support as much as R&D start-ups located 'on campus'. Therefore, it could be assumed that R&D start-ups not located 'on campus', are less dependent on (financial) support (i.e. venture support) and see more value in 'presence of knowledge' for other reasons, because of a more financial independent position which broadens the R&D start-ups' scope of interest regarding their location choice (Freeman and Engel, 2007). This could also change their perception on the added value of 'presence of knowledge', since the importance score is greatly higher on off-campus proximity ranges.

Start-up A (on campus) replied: the presence of knowledge could be beneficial, but the start-up experienced that access to knowledge (and facilities) is not always obvious. This could imply that the benefits of proximity-and interaction between actors on campus are exaggerated. Or as the article of Torre, 2008 states: *"…Short-or medium-term visits are often sufficient for the partners to exchange the information needed for cooperation. The mobility of individuals makes it possible to implement this mechanism. Temporary geographical proximity implies a strong relation to space, but one that differs in nature from that described by the traditional approaches…"*(Torre, 2008, p. 46).This statement and this study's results imply that geographical proximity is not as essential for knowledge exchange-and partnering as broadly implied across numerous scientific articles stating combined benefits of knowledge spillovers and geographical proximity (Atzema, 2008; Boschma, 2011; Wetering, 2006). A high density of (similar) actors within a region could even inhibit the internal functioning of the R&D start-up (Zondag, 2008). On the other hand, lack of interaction between R&D start-ups and other actors can also be facilitated by inadequate action from the policymaker side. It is the policymakers' role to facilitate and guide interaction between these actors. According to the findings of this study, there is actually little demand for formal interaction between other R&D start-ups and cooperation between different R&D start-ups also creates new problems (Freeman and Engel, 2007).

R&D Start-up A and C (On campus) replied that the presence of knowledge is not the detrimental factor, but the extent to which the start-up has access to knowledge is. Start-up B (on campus) for instance mentions that it would like to receive affordable access to the library (this includes knowledge), but that access currently is too expensive for this starting venture. The article of Wetering supports this statement by stating that; "Often there is a misunderstanding between scientists and entrepreneurs, therefore making it important that they understand each other." (Wetering et. al., 2006, p. 46). This statement from the article of Wetering, 2006 was also backed up by the face-to-face interviews with policymakers, investors and large companies indicated that collaboration between other R&D start-ups should be guided properly to avoid miscommunication, but R&D start-ups stated they have little time for collaborations and risks are too high.

Venture support

The location choice in regard to the factor 'venture support' is rated the highest in the 0-2 km (score: 4.4) proximity range and lowest in the 'on campus' (score: 2.5) proximity range. The proximity ranges 2-5 km (score: 3.4) and > 5 km (score: 3.0) lay in the middle. These results indicate that the level of 'venture support' provided by the campus may be of influence to the location choice of R&D start-ups. Wageningen UR Figure 12 shows the Startlife (i.e Starthub) building once was an old facility building now used by Wageningen UR for housing of R&D start-ups.

Figure 12: The Startlife (i.e Starthub) building is an old facility building once used by Wageningen UR and now used for housing R&D start-ups (source: author's own work, 2016).

The low score of 'on campus' R&D start-ups is quite remarkable, because according to various articles one would suspect 'venture support' to be one of the most important factors, especially for low capital/experience R&D start-ups located in the incubation area. Results from this study could indicate the lack of well-fitted venture support. R&D start-ups demand different types and levels of support depending on the R&D start-up and the capability of the incubator program (Di Gregorio, 2003, start-up B (on campus)). On the contrary, being connected to an incubation program improves the R&D start-ups 'credibility', 'time to maturation' and 'reduces probability of failure' according to

> *'well, when you start you are always looking outside for reassurance; when you are in the incubator, sure you have your own name and the company is yours but it's sometimes almost like it's a communal project before you do anything you worry about asking everyone else, what they think, what it was like for them. When you are further along the line, you can do it yourself, you don't need the others and to be honest, you are not that interested in what they're doing and certainly less willing to share, they must find their own ideas, we need all of ours!' (McAdam & McAdam, 2008, p. 361).*

Rothaermel & Thursby, 2005 (Rothaermel & Thursby, 2005). Then again, the direct-and indirect positive effects on the firm are difficult to assess, this study also only provides a glimpse on the matter. Or as the article of Rothaermel & Thursby, 2005 states:*"…it is difficult to conduct an econometric analysis of the consequences of the performance of firms in technology incubators, who play an increasingly important role in the innovation infrastructure and regional economic growth…"*(Rothaermel & Thursby, 2005, p. 45). Seeking consultation advice for developing technical 'products & services' is not the main concern for R&D start-ups according to this study. The article of Chan & Lau, 2005 support this argument by stating that: *"technology founders are usually the experts in their own field. Consultants appointed or recommended by a campus might not be of direct relevance. Secondly, most founders express their concern in our fieldwork interviews that they are afraid that the product technology would be stolen by outsiders if they talk to consultants about this. On the other hand, our study reveals that in the venture development process, technology founders are usually keen to seek business advice as it is the area that they do not know. In addition, it is of immediate and practical use in every day operation. Once again, geographic proximity is also found to be related to: how often technology founders seek consulting help from incubator…"* (Chan & Lau, 2005. P. 121). These findings disagree with the article of McAdam & McAdam, 2008 where it is stated that: *"during the start-ups transition to maturity the entrepreneurs became more sensitive to possible problems that proximity might present to the firm" (*McAdam & McAdam, 2008, p. 286)*.

There seems to be a paradox between R&D start-ups situating 'on campus' and their perceived benefits in regard to 'venture support'. These R&D start-ups have a demand for 'venture support' 'on campus', but become disappointed by the level of venture support that the campus offers. In the end, these R&D start-ups are seeking the desired 'venture support' elsewhere, outside the region. On the other hand, some R&D start-ups are unwilling to share information. To 'top it off', the article of Baptista & Mendonca, 2010 claims a possible broader interpretation of this finding, namely that: *"…Such theories in support of the value of campuses in fostering rapid growth of small technology start-ups is not confirmed. Strong views are presented by some young tenants in the study stating that the argument is more of a political show to justify government's investment in establishing campuses and incubators …"* (Baptista & Mendonça, 2010, p. 62). The real motives from the policymaker's perspective are dynamic, though the symptoms that were addressed during this study appear to bolster in the direction which Baptista & Mendonça, 2010, describes. One the other hand, this does not seem to be problem for R&D start-ups, since other benefits of being situated 'on campus' weigh up against the current quality of 'on campus' 'venture support'.

Use of facilities

'Use of facilities' is valued almost equally as a location factor choice in all four proximity ranges 'on campus' (score: 3.5), 0-2 km (score: 3.3), 2-5 km (score: 3.4) and >5 km (score: 3.5). This indicates, according to this study, that geographical proximity might not be as much of influence on the location choice regarding 'use of facilities'. This finding is directly in contrast to the results of Chan & Lau, 2005, namely that: *"…geographic proximity to universities is found in our case study to be a determinant affecting the use of shared technical resources like laboratory, workshop facilities, etc. by technology firms…"*(Chan & Lau, 2005, p. 1216).

Different kinds of R&D start-up development phases require different types of support (and thus facilities) in pursuing growth orientated strategies (McAdam & McAdam, 2008). R&D start-ups mentioned the lack of business support, and access to facilities (laboratories, tools) are not always well provided for. An interviewed and more developed R&D start-up replied that the use of Wageningen UR's laboratory made the R&D start-up get in contact with other business partners that he knew from a different project he once conducted in Wageningen city. The article of McAdam & McAdam, 2008 backs this up by stating: *"In order to achieve these goals it is necessary to have effective team building skills but also networking capabilities in order to access required information and resources."*(McAdam & McAdam, 2008, p. 278). On the contrary the article of Chan & Lau, 2005 states: *"…However, sharing technical resources among firms is found not valid in our study as technology-related resources are varied from tenant to tenant…"* (Chan & Lau, 2005, p. 1227). This shows that the results regarding 'use of facilities', just as is the case with venture support, are divided. In some cases, R&D start-ups are capable of using these facilities elsewhere regardless of the typology of these R&D start-ups.

Vicinity of customers/suppliers

R&D start-ups located 'on campus' (score: 4.7) and >5km value (score: 4.2) rated 'vicinity of customers/suppliers' more than the other two proximities '0-2 km' and '2-5 km' (score: 3.6 and 2.6). These results show that vicinity of customer-and suppliers is related to geographical proximity of R&D to the campus.

A strange observation is that R&D start-ups located 'on campus' are mostly internationally orientated, see section 4.1 'R&D start-ups per proximity range. This observation also collides with the article of Panne & Dolfsma, 2003, stating: *"…For young high-tech companies, labor market characteristics are irrelevant, and the insignificance of agglomeration indicates that the Netherlands are indeed an urban field…"* (Panne & Dolfsma, 2003, p. 76). This indicates that for food-and green high-tech R&D start-ups 'vicinity of customers/suppliers might be a more important factor than for high-tech R&D companies in general. Also, this location factor could have been interpreted differently by these R&D start-ups. For instance: maybe the vicinity of suppliers is important but the vicinity of customers (which are located international) are not as important for R&D start-ups. A second explanation could be that R&D start-ups experience (e.g. communication) problems with internationally orientated customers/suppliers, which do not occur with customers/suppliers in closer vicinity of the R&D start-up. The article of Laursen & Salter, 2004 backs these possibilities up by stating that, although a R&D start-up may be internationally orientated, conventional local suppliers and customers continue to be prime in manufacturing the R&D start-ups innovation acitivities (Laursen & Salter, 2004). Further research on the added value of close proximity of customers/suppliers in relation to their international orientation might be interesting to explore.

Vicinity of highly educated personnel

'Vicinity of higher educated personnel' as a factor is influenced by proximity. 'Vicinity of highly educated personnel' is least preferred by R&D start-up located 'on campus'. The 0-2 km (score: 4.5) and 2-5 km (score: 4.2) are rated the highest, while the proximity range 'On campus' (score: 3.7) and proximity range >5 km (score: 3.1) are rated much lower.

This result is not directly derived from the results. This finding can be backed up because R&D start-ups located on campus are mostly R&D start-ups set-up by students with relatively few employees. The general added value of 'presence of highly educated personnel is supported by the article of Benia et al., 1993, stating: *"…The clearest and most visible mechanism creating spillovers is the hiring of local university graduates whose education and training embodies some of the fruits of academic research…"* (Benia et al., 1993, p. 34). The results also clarify that R&D start-ups located in the >5 km range do not value this factor as much. This could be for a number of reasons, according to the article of Baptista & Mendonca, 2010 one of them for instance is that: *"…Founders of new firms in Portugal tend to locate their businesses in close proximity to their homes, and therefore a significant number of entrepreneurs set up their businesses in their own municipality…"* (Baptista & Mendonça, 2010. p. 87). This study does not go further into detail why 'highly educated personnel' is not an important factor in the location choice of R&D start-ups that are located far away (> 5 km) from the campus although the score decrease over the proximity range does follow an expected line.

Diversity of lively activities

'Diversity of lively activities' as a factor for location choice of R&D start-ups is influenced by proximity in the 0-2 km range (score: 3.8). 'Diversity of lively activities' is least preferred by R&D start-up located '> 5 km' (score: 2.5) from the campus. Proximity ranges 'on campus' (score: 3.2) and 2-5 km (score: 3.0) are in the middle. A start-up on campus thought of increased diversity as 'unnecessary distraction' of where a start-up from the 0-2 km range replied that it would attract businesses to the area; which the R&D start-up thinks it is a positive development. This shows a range of different opinions regarding the matter. The article of Raspe states: *"…In essence this rising demand for accommodation has been one of the sources of impetus for the growth of real estate and property value in the proximity of campus localities…"* (Raspe, 2009, p. 213). This shows that growth of diversity of activities means growth of demand to be situated in that region; which therefore raises value of the campus. On the contrary, there is a side note to make regarding the increasing popularity of campuses. Additionally, added benefits for R&D start-ups might be misinterpreted due to disinformation nonetheless (Amelink, 2003). The article of Bok, 2009 states: *"Most critics do not paint the current situation in quite such bleak colors. But many are afraid that commercially oriented activities will come to overshadow other intellectual values and that university programs will be judged primarily by the money they bring in and not by their intrinsic intellectual quality…"* (Bok, 2009, p. 23). Eventually the intellectual quality output of the university is essential to R&D start-ups as well one would think. This thesis shows that, apparently, intellectual quality output is not as essential for R&D start-ups as it may appear in literature. Bok, 2009 describes this very well: *"…surrounding economy draws more-and more students into vocational fields of study, elevates the salaries of computer scientists, business school professors, and others whose work relates to business, and attracts ever greater sums of outside money for subjects of commercial relevance to the neglect of other worthy, but less practical, fields of study. Even those who support the university's efforts to aid economic growth worry about the side effects of profit-seeking and the unseemliness of institutions of learning hawking everything from sweatshirts to adult education…"* (Bok, 2009, p. 43). 'Diversity of activities' is still a vague concept, but commercializing a campus may attract certain companies. These companies can afford to be situated on that campus; making difficult for other fields of education and business sectors to take part on that same campus. This, in turn, may jeopardize the campus' diversity in knowledge creation other types of businesses as well.

Meeting spots/opportunities

Start-ups located 'on campus' (score: 4.5) and 0-2 km (score: 4.1) from the campus prefer meeting opportunities more than the other two proximity ranges 2-5 km (score: 3.3) and > 5 km (score: 2.6). Little literary articles are written about the connection between 'the number of meeting spots/opportunities' and proximity to R&D start-up companies. The articles of Dagevos & Tomor, 2011 and Atzema, 2008 do state that meeting is an important location factor for young companies on a campus. The article of Atzema, 2008 adds that the relation between *living, education and working* on campus improves integration between students on campus and other participants. Figure 13 shows an image of the new plaza building, having a typical American campus quad, which looks like a copy from the American campus model (Zondag, 2008).

Figure 13: Typical campus quad, which is supposed to induce interaction between stakeholders on campus, Plaza (Plegt-Vos, 2016)

The debate of diversity on campus and value creation coincides with one of the element of diversity: meeting spots/opportunities. Yes, interacting is important, but to what extent do people interact without a clear incentive. The incentive often originates from shared interests between two people. The question is whether more meeting spots and opportunities will produce more interactions. Again, a large number of truly spatially designed meeting spots could also be a way of shaping the Wageningen UR campus' image. Moreover, the article of Baptista & Mendonca, 2010 states: *"…it is found in our study that technology start-ups do not gain any benefits from networking and clustering..." (*Baptista & Mendonca, 2010, p. 59)*. This could imply the need for interaction between stakeholders, but that the number of meeting opportunities do not seems to fix the problem of networking.*

A remarkable observation is that especially R&D start-ups located close to the campus rate this factor so highly with their location choice compared to proximity ranges further away. This could imply multiple interpretations of these results. For instance that, at the time, R&D start-ups located close to-or on campus were benefiting a lot from meeting

Figure 14: Open architecture of Actio building (Wageningen UR) campus should facilitate interaction according to the article of Talen 1997 (Talen, 1997).

spots/opportunities. Or that R&D start-ups did not benefits from the current available meeting spots/opportunities as much as expected but still think it is an important aspect that might assist the company in the near future (MISTRA, 2013). One of the start-ups from this study replied that, since moving its business on campus, it began to see the added value of the meeting spots. The R&D start-up did not acknowledge/realize added value of these meeting spots before moving to the campus. The question that arises from these results is: 'Is this perception typically created due to marketing-image influence of the Wageningen UR campus?' (Buursink, 1991). From face-to-face interviews with a R&D start-up located in the > 5 km range, the response was that meeting spots and opportunities are not perceived as a vital element for the survival of the business. Figure 14 shows how the open architecture of the Actio building allows spontaneous between parties to emerge on campus.

Open green space

Open green space was rated highest in location choice by R&D start-ups located 'on campus' (score: 3.5).R&D start-ups located in the 0-2 and 2-5 km proximity range (score: 2.9 and 2.7) and >5 km (score: 2.7) value 'open green space' the lowest of the four proximity ranges.
Face-to-face interviews with R&D start-ups located on campus state that open green space is regarded as a fitting element of the campus. This could indicate that the image of the campus and its surroundings is more important for R&D start-ups located 'on campus', than R&D start-ups located near or further away from the campus. Or do R&D start-ups, which are crammed up together in an old incubation building, long for a walk on the open green campus after a stressful day at work? As mentioned before, 'open green space' is not the most important factor in location choice, but does seem to fit with the image debate, that also is strongly linked with 'presence of knowledge'. The article of Dagevos and Tomor concluded that location actors like; conditional *access to labs and facilities, eating-and meeting spots and presence of qualified personnel and open green space* increases the attractiveness of a cluster (Dagevos and Tomor, 2011). In regard to 'open green space' for R&D start-ups located on campus this statement is support according to this study's findings. Or as the article of Amelink states: *"…Green spaces are also reported in terms of resultant effects on perceptions and behaviors…"* (Amelink, 2001, p. 78). A R&D start-up located on campus stated that the diversity of education and image of Wageningen UR campus is not reflected in its green open surroundings. This result is backed-up by the article of Griffith, 1994): *"…Therefore, there seem to be opportunities for using green spaces (including the more naturalistic ones), to raise students' awareness about, and understanding of, ecological diversity…."* (Griffith, 1994, p. 23).

Co-location

'Co-location' in the form of 'vicinity of a large related company' was rated as the lowest average location factor in location choice among all respondents within the written interviews. Again, start-ups 'on campus' rated this location factor the highest (score: 3.5) of all proximity ranges. Other proximity ranges scored: 0-2 km (score: 2.2), 2-5 km (score: 2.6) and > 5 km (score: 2.3).
The previous paragraph showed that R&D start-ups do not think the presence of other R&D start-ups or larger companies within their vicinity is very important, especially R&D start-ups that are located on campus (close to each other). R&D start-up located on campus value co-location significantly more than start-ups located further away from the campus. R&D start-ups located 'on campus' state that they would definitely like to have more business supporting and specialized/ related large companies on campus.

If one would assume the articles of Wetering, 2006; Atzema, 2008 and Aunt-Bernard, 2001 regarding the added benefits of knowledge spillovers from large related companies to the region to be applicable in this case. At first glance, one would also assume R&D start-ups will benefit from co-location, and the other way around larger companies will benefit from R&D start-ups. The article of Aunt-Bernard, 2001 adds: *"…spillovers do not occur in the same way from one area to one another. They are geographically bounded. Actually, an area benefits only from the research activities of its close neighbors, and not from the research of more distant areas…"* (Autant-Bernard, 2001, p. 44). From this study's findings and in other research articles, this statement is much debated, because access, image and self-interest are in conflict with the knowledge-spillover concept (Zondag, 2008).It is not very important for R&D start-ups that need some support, where that support is coming from, as long as it is affordable and those R&D start-ups are able to have access to it. Therefore, large related companies could be part of the needed interaction-and support some R&D start-ups are looking for (Knaap, 2013). This study shows that policymakers state that the necessity of cooperation with larger companies for both sides could be vital in some cases, but according to this study's findings, from the R&D start-up side; working together with a larger company as well as having a

larger company in its vicinity does not seem to be in the R&D start-up's best interest. The article of Toddling & Tripple, 2007 adds: *"…most flows of qualified labor between academia and firms is very little…"* (Toddling & Tripple, 2007, p. 61). In literature even the opposite adverse effect of co-location is stated; that it might have a negative influence of knowledge creation in R&D firms. Or as the article of Chrinsomboon states: *"…A concern would be potential cannibalization of intellectual property between incubator tenants, if not managed properly. The proximity among tenants and "water-cooler effect" play a reverse role here…"* (Chinsomboon, 2000, p. 121).

6.3 Comparison of R&D start-up results and policy documents

Table 8 of chapter 3 'Methods' shows that the most recurring location factors within the policy documents are 1) presence of knowledge (30%), 2) venture support (15%), 3) facilities (14%), 4) diversity of activities (12%). These results are used in section '4.2 valuation of location factors' to support the findings per location factor. This finding matches with the results in the sense that presence of knowledge (score: 3.8) is the most important location factor and the other location factors have a comparable valuation score compared to the recurrence of those location factors within the policy documents. The difference is that highly educated personnel is not even included in the top 5 highest rated location factors of the policy documents and that diversity of activities is much recurring while the results of this thesis indicate that this location factor is not that important for R&D start-ups. This finding is further elaborated in the 'recommendation' chapter 7.

6.4 Recommendations

This chapter provides research and policymakers of the Wageningen UR campus and other recommendations in regard to the findings from this thesis.

6.4.1 Research recommendation

This section contains recommendation for future research regarding R&D start-ups and their preferences regarding the campus and its surroundings.
It is recommended to investigate how international stakeholders can be attracted to come to the campus. This can be done by finding out which factors would impact their location choice and motivation to come to the Netherlands. To improve low-key interaction opportunities between R&D start-ups at Wageningen UR and students/graduates, it is recommended to research what types of low-key interactions are possible and desired from both sides. At the moment, at Wageningen UR campus, this low-key low cost interaction is currently an unexplored field that promises potential. In return this low key stakeholder interaction can be marketed towards international stakeholders and used to boost the image of the campus. Therefore, role of the Wageningen UR campus' image on various stakeholders is a possible recommendation for future research in general.

For future recommendation, it is also recommended that a second research is be conducted. This research can either attempt to reach other R&D start-ups or focus on a certain class within the classified heterogeneous group of R&D start-ups. Reaching other R&D start-ups will add to the data collection of this study and therefore may strengthen legitimacy of conclusiveness of certain aspects of the results of this thesis. Another recommendation for future research is to research the actual potential of R&D start-ups collaboration with each other or third parties. Part of this study should also examine why some R&D start-ups did better than others and, in case it went bad; discover and evaluate what the reason to leading to a certain outcome was.

Another recommendation for future research is to find out why some R&D start-ups do not value 'presence of knowledge' or other Knowledge hub specific location factors as much as other R&D start-ups. The R&D start-up groups that did not value 'presence of knowledge' as much in the location choice as other R&D start-ups are 'Production' (3,9), 'Barely a connection (with university)' (3,8) 'Selling product/service (3,7) 'Not international (market)' (3,3). The reason why this is interesting for future research is because those R&D start-ups may not feel connected to the Wageningen campus as much as other R&D start-ups do. Attracting those businesses is part of the challenge for policymakers as well. Another future research recommendation is to discover why R&D start-ups are located so remote from the campus. Respondent A of the policymakers' face-to-face interviews mentioned that Wageningen campus has an 'elite' image to overcome. The extent to which this problem is a common occurrence among R&D start-ups not located close to the campus (within Food Valley or beyond) is interesting for future research.
Another idea for future research is to compare strategies, policies and visions of Agro Food campuses from across the Netherlands with each other. This could in return provide insight in to what extent a certain campus/regional approach works or not. What also if interesting for further research is to see whether if all the required level of knowledge/venture support is attainable 'on campus', this would improve the internal functioning of those R&D start-ups.

More specifically, regarding section '6.2 What is important for R&D start-ups?' (last sentence of the last paragraph) it is recommended to further research on 'new technology, 'production based' and 'bad connection' R&D start-ups to examine whether the 'on campus' location or these characteristics are connected to lower scores of 'presence of knowledge' and 'venture support' compared to other

R&D start-ups and proximity ranges.
Additionally, regarding 'sub-section' 'vicinity of customers/suppliers' of section '6.2 What is important for R&D start-ups?', it is interesting to investigate why ' internationally orientated R&D start-ups value ' vicinity of customers/suppliers' more than other R&D start-ups and how this could be facilitated.

6.5 Policy recommendation

6.5.1 Important location factors to R&D start-ups on the Wageningen campus

The following sections give a recommendation based on the face-to-face interview results, the discussion chapter and the overall valuation of the location factors fathered in the written interviews. Firstly, it is recommended to keep the focus of the development of the campus on preserving the core quality 'presence of knowledge' mainly in regard to sustaining the image of the campus. The importance of the link between these location factors within the recommendation is described in the following paragraphs:

In the location choice of R&D start-ups, the **image** is a very important location factor that overarches numerous location factors. This thesis' results from the face-to-face interviews revealed a very strong link between the 'image of the campus' and 'the presence of knowledge'. Some R&D start-ups did not realize a potential in meeting other actors on campus, only after they moved to the campus itself. Once R&D start-ups were asked to what extent other location factor were important to them, the counterargument was mostly related to the preservation of the image of the Wageningen UR campus. This argument was used to back-up the notion that green open space between buildings of the campus should be persevered so that the surroundings fit with the green image of Wageningen UR. In regard to improving and sustaining the image of the campus, the following is needed;

The finding that '**presence of knowledge**' is rated the highest among all the other location factors and the face-to-face responses regarding this location factor. 'Presence of knowledge' as a definition is intrinsically a holistic location factor, because it could be related to highly educated personnel, image and knowledge spillovers, for instance. The face-to-face results gave better understanding of the R&D start-ups interpretation of the added value of this location factor. The results of the findings of this thesis gave the impression that 'presence of knowledge' should remain the core characteristic location factor in regard to how influential it is to the perception of the current (international) image of the Wageningen UR campus.
Therefore, the recommendation for policymakers is to focus on strengthening this core quality 'communication of possessing knowledge' as it is both a valuable asset in research and innovation as it is an valuable asset in supporting the overall image of the Wageningen UR campus. This core quality should therefore always be kept in mind when altering spatial features of the Wageningen UR campus as well. Wageningen UR campus currently visually communicates the 'Wageningen Knowledge hub qualities' (mainly presence of knowledge, and highly educated personnel) that the R&D start-ups located on and around the campus are looking for.

The finding that '**vicinity of highly educated personnel**' overall is rated the second highest among all the other location factors. There is a difference in perception on this location factor, because campus investors and larger companies were convinced that highly educated personnel is mostly an important location factor for larger companies, but the findings from this thesis indicate that it also is an important location factor for R&D start-ups. The face-to-face interviews indicate that R&D start-ups are very interested in interaction with students and other stakeholders on campus as this may bring mutual benefit for both parties. Also multiple R&D start-ups replied that they have some sort of

connection with highly educated personnel from the university or the university itself, which helped their business further (low-key and low-cost flexible collaboration). The policy documents show that 'presence of highly educated personnel' is not a recurring location factor compared to the other investigated location factors. Therefore, from the R&D start-up perspective, it is advisable for policymakers of the Wageningen UR campus to take into account the importance of the 'vicinity of highly educated personnel'.

Because of the mutual benefits and in-practice proven synergy between highly educated personnel/students from the university and R&D start-ups it is advisable to stimulate spontaneous interaction and mutual awareness among those parties. For 'on campus' R&D start-ups highly educated personnel is not an important motive for their location choice, but **access to affordable supplies** is. Since those R&D start-ups are mostly orientated on an international market, it is advisable to look on the supply side. One R&D stated that an electronic company in the vicinity would be handy for their projects.

And thirdly, '**meeting spots and opportunities'** are rated as one of the highest of all location factors. This results lays in line with the low-key spontaneous interaction opportunities R&D start-ups can have with stakeholders on campus, the R&D start-ups replied.

In regard to the importance of R&D start-ups to have 'highly educated personnel' in its vicinity, this location factor can be combined with more meeting opportunities in which the highly educated personnel and students can communicate and interact. This can also imply that current meeting spots can be utilized for R&D start-ups to show the highly educated graduates or personnel the ins-and-outs of their business.

The campus buildings created awareness of the spatial potential for interaction. Also, the R&D incubation terrain 'Start-life' located on campus is now merely known as an office housing for individual R&D start-ups. The potential for mutual interaction and integration of entrepreneurs with students/graduates can be still be improved. The potential on both the educational as on the entrepreneurial side for this interaction is promising and still remains fairly unexplored by R&D start-ups.

6.5.2 Less important location factors for R&D start-ups near the Wageningen campus

Because the location factors 'vicinity of a larger company' and 'open green space 'are rated lower than the previously mentioned important location factors, the recommendation is to focus on sustaining the more important location factors according to the R&D start-ups mentioned before (image, highly educated personnel, low-key interaction).

R&D start-ups do not see a lot of value in the addition of other larger companies in the close vicinity of their R&D start-up. Some R&D start-ups that responded were worried that the replacement of open green space of the campus will distort the current green and open image of the campus. Other R&D start-ups state that the influence of companies on campus might further institutionalization and influence direction of R&D start-up's businesses. Other R&D start-ups state that it might come handy to have a larger company in the vicinity when those companies have the right orientation to that could assist. The image of the Wageningen UR campus may be distorted because 1) the green open space of the campus will be replaced. This green open space is a key characteristic of the 'green' campus image of Wageningen UR. 2) The other reason is that the addition of larger companies on campus may influence the 'knowledge core' quality of the Wageningen campus created by the Wageningen University in multiple ways. Diversity of lively activities is perceived as unnecessary distraction and can also distract 'outside' observers from what the Wageningen UR campus represents: green, diverse and unique knowledge hearted university campus (FoodValley, 2014). This is in contrast with the finding that 'diversity of lively activities' on campus/ in the region is a much recurring location factors within the policy documents of table 8, chapter 3. Therefore it is advisable

to carefully re-evaluate how certain activities added to the campus influence R&D start-ups and what this means for campus development.

6.5.3 To what extent does Wageningen UR campus provide?

The Wageningen UR campus falls short in creating knowledge spillovers for R&D start-ups on-and around the campus. Besides not communicating that R&D start-ups can get access to knowledge spillovers and facilities, the Wageningen UR campus also does not always grant this access. R&D start-ups reply that 'openness to external users' is promised, but not always granted. The communication of the possible knowledge spillover stakeholders on campus and to which facilities the R&D has access to, could be communicated better. Less well-developed R&D start-ups on campus do use the basic venture support programs, but more developed R&D start-ups state that further venture support (business handling) is attained in other regions. The Wageningen UR campus could improve Startlife (the current incubation organisation) or attract other R&D start-up support organization to the campus, so that that the attractiveness of the Wageningen UR campus increases for R&D start-ups. R&D start-ups take into account the possibility of attracting future employees and were/or still are a reason to be situated on that campus (which is not acknowledged by policymakers and campus investors). Policymakers can start separate programs within the university that introduce graduates or students to the entrepreneurial side of the Wageningen UR campus. Besides, the Startlife organization can facilitate interaction events that support the link with highly educated personnel from the university and R&D start-ups (also in regard to the need of R&D start-ups to have more informal contact with other stakeholders on campus). This could mean a link within the organization that facilitates internship opportunities, symbiotic projects and volunteering work between graduates, students and R&D start-ups. R&D start-ups stated clearly that more diversity on campus seems as unnecessary distraction and is rated low compared to the other location factors. The recommendation therefore would be to not increase diversity to the extent that the Wageningen UR campus' quality of the knowledge heart image is jeopardized. It is recommended to keep the "open atmosphere" on campus, but more diverse and lush natural aspects can be added so that it fits the diverse and green nature of the image of the Wageningen UR campus.

6.5.4 What is the role of proximity?

R&D start-ups closer to the campus benefit from the 'presence of knowledge' in regard to the image benefits it brings. But R&D start-ups complain about the expected benefits from knowledge spillovers that are not self-evident. R&D start-up located further away do not 'value presence of knowledge' in the sense of potentially using knowledge spillovers but only in the sense of the image of the campus of Wageningen UR and the benefits it brings to the R&D start-up. R&D start-ups benefit from the image more than from knowledge spillover opportunities because those R&D start-ups are better developed and feel less attracted to the benefits that presence of knowledge brings but still want to be associated with the Wageningen UR campus. The recommendation therefore is, to maintain or improve the image of the Wageningen UR as this is bound to the proximity to the campus in regard to the image but not in regard to knowledge spillover opportunities.

Other than presence of knowledge and image, venture support, vicinity of customers/suppliers, meeting spots/opportunities, open green space, co-location is all rated the highest by R&D start-ups located 'on campus' or closer to the campus (0-2 km) than the other proximity ranges (2-5 km and > 5 km). This means that these location factors are more important for R&D start-ups located closer to

the campus. The recommendation therefore is to focus on improving these location factors for attracting R&D start-ups that want to be situated on-or near the campus (note: that this is a small group and that these results deviate from the average valuation of location factors).
Vicinity of high educated personnel is most interesting for R&D start-ups located in the 0-2 km range. The recommendation therefore is to find a connection between these R&D start-ups students and graduates as is mentioned before in the previous section '7.2.3 To what extent does Wageningen UR campus provide?'. The low-key interaction example from the previous section is a good example. According to the results of this thesis; 'use of facilities' and 'diversity of activities' is not bound to proximity in the R&D start-ups' location choice as much compared to other location factors. But a deviation in results for 'diversity of activities' is visible in the 0-2 km range. It is therefore recommended not to invest in more diversity of activities for attracting R&D start-ups overall. It is recommended to look for R&D start-ups further away from the campus in regard to facility sharing. Also, R&D start-ups in the 0-2 km range value 'diversity of lively activities' and 'meeting spots/opportunities' more than other proximity ranges. These results show that the R&D start-ups located 'on campus' and in the 0-2 km range have a tendency towards valuating more agglomerate specific location factors, see analytical framework. Another observation is that R&D start-ups located 'on campus' actually rate 'vicinity of a larger company' higher than the other proximity ranges. Therefore, the recommendation for policymakers is to focus on improving 'presence of knowledge' aspects (for its image), remaining the open atmosphere of the campus but improve the connection between highly educated personnel from the campus and R&D start-ups, because these aspects still remains the most important aspects for R&D start-ups overall. That the R&D start-ups 'on campus' and in the 0-2 km range value characteristic agglomerate type of location factors more than the other proximity ranges. This does not mean that the Wageningen UR campus should build on more 'diversity on campus' or 'the vicinity of a larger company' when looking at these results. This may jeopardize the image and knowledge core of the campus and consequently affect other R&D start-ups as well. After all, Knowledge hub specific location factors are valued much higher overall compared to location factors that are not specific to this type of Knowledge hub campus.

6.2.5 Nutshell recommendation

The recommendation in a nutshell is to build on the core qualities (image and presence of highly educated personnel) of the campus. This means that 'presence of knowledge' related aspects in regard to image creation towards the (international) market should improve. Besides, improving quality of current meeting and interaction spots and finding additional focus and attraction of international stakeholders are important in regard to improving the image of Wageningen UR campus. Enable low-key interaction and make these interactions flexible and affordable. For instance, let stakeholders (graduates, students) on campus interact with the R&D start-ups on an formal and informal basis. In regard to venture support, better support programs and access points to knowledge spill-overs should become available, especially for R&D start-ups on campus.

7. Research framework revision

This section evaluates the contribution of this thesis to spatial concepts and other concepts mentioned in the analytical framework (chapter 2.2). According to the analytical framework in chapter R&D start-ups located on the Wageningen campus (Knowledge hub) are besides 'presence of knowledge' within their location choice expected to have venture support, campus facilities, labor market, open green space. After analyzing the data, the branding aspect of the campus seemed to be the overarching concept that plays a fundamental role in regard to perceiving the added value of the investigated location factors. In regard to the classification of R&D start-ups no sound conclusions can be made regarding a strong correlation between R&D start-up's characteristics and specific location choice because of the small number of R&D start-ups per criteria group, but the data does show possible connections between the scores of location factors, proximity ranges and characteristics of R&D start-ups. From the results it is noteworthy that R&D start-ups that are in the criteria groups 'set-up, product & service development' and 'service provision' value; 'presence of knowledge' most compared to other R&D start-up groups. As mentioned in chapter 2 'presence of knowledge' is the main specific location factor of the Wageningen UR campus as a Knowledge hub. Besides, R&D start-ups that have an 'average to good connection' with the university rate 'presence of knowledge' third highest of al criteria groups. The following spatial disciplines/theories were used to assess whether R&D start-ups with different preferences towards certain (Knowledge Hub specific). The data from this thesis, also provide insights about the used spatial disciplines and theories.

The spatial disciplines/theories used in this thesis (see analytical framework) show that:

- According to this thesis results, the whole "green open atmosphere" of the Wageningen UR campus is mostly important to R&D start-ups mainly to support the campus' image, because this indirectly benefits them more than any other benefits that the 'open green atmosphere' brings directly to that company (think of: a walk during a lunch break). This means that the **production environment** theory, that bases its company's internal function is more sensitive to the subjective experience of stakeholders that are associated with the R&D start-up (especially towards (international) customers of the R&D start-ups; the outside world). Actual use of knowledge spillovers and facilities created by the Wageningen UR campus is limitedly utilized by these investigated R&D start-ups. This thesis' results show that R&D start-ups do not perceive this limited use-and access of these assets as a big obstacle, because, as they say, 'they can find this knowledge or facility assistance, elsewhere, outside the region' (like venture support for business development or lab uses). It are the 'on campus' R&D start-up companies that are (often) founded on campus itself; that seek assistance on campus grounds or in closer proximities to the R&D start-up. These R&D start-ups also state that they can acquire this support elsewhere, if needed. These on/near campus R&D start-ups perceive these so called 'potential campus benefits' as more potentially beneficial for the R&D start-up than R&D start-ups located further away from the Wageningen UR campus. The R&D start-up founded on campus replied that the campus lacks low-key interaction opportunities for R&D start-ups with other campus stakeholders. These R&D start-ups added that the low key interactions should be mutually beneficial, easily approachable and affordable for these R&D start-ups, but also for the stakeholders on campus (like students and graduates) that could potentially interact with the R&D start-up founded on campus. The R&D start-ups clearly emphasized the potential of the campus once located there, focusing on the interaction possibilities and the internationally acknowledged image of Wageningen UR.
So in short: Most of the face-to-face R&D start-ups indirectly refer to the image of Wageningen UR campus being one of the most mentioned connectors to the campus, above all other location factors mentioned in the analytical framework. The potential of the campus (besides its image) was quickly

recognized by those R&D start-ups that moved to the campus (especially on low-key stakeholder interaction). 'On campus' and '0-2 km' R&D start-ups are disappointed in regard to the expected access to the use of facilities, knowledge and various forms of venture support promised (communicated) by the Wageningen UR campus. More developed R&D start-ups state that this lack of access to resources is not negatively influencing the business' internal functioning, because these resources are easily acquired elsewhere, while on-campus R&D start-ups mention improvements but are generally content with their location choice. It also shows that the valuation of potentially accessible location factors of the campus is rated higher by R&D start-ups located on campus itself. The results indicate that there is a correlation between higher valuation of location factors, and the proximity of the R&D start-up to the Wageningen UR campus. R&D start-ups also stress the importance of what is communicated towards the out-and inside world. Even though a different form of reality was communicated towards the R&D start-ups before they moved to the campus, those R&D start-ups still remain near or on campus today. This shows that the message towards the outside world is what the R&D start-ups care a lot about. This shows the power of perception towards the valuation of the Wageningen UR campus production environment (Amelink, 2003).

7.1 Which theories can be sharpened by having these findings?

- The **campus concept** mentioned in chapter 2.1 refers to a campus being: A "*…a planned development of high technology enterprises in an attractive physical environment with close links to a university…*" (*Matthias, 1986, p. 116*) and *"…essential synergy between academic institutions and firms to collaborate…"* (Vila & Pagess, 2008, p. 57). The results from this thesis show that for R&D start-ups that are not located on campus or bound to an incubation program, are mostly interested in the image of the campus. The synergy Vila & Pagess, 2008 mentions in this case is connected to the perception of the campus by the outside world, and by the campus participants (Amelink, 2003). Vila & Pagess, 2008 states there is an essential synergy between these R&D start-ups, but the results from thesis show that the synergy (in the sense of available resources) is not that essential in regard to the R&D start-up's point of view. This so called: 'essential synergy' is more of a 'favorable addition' to the internal functioning of the R&D start-up.

Also, a connection with the Wageningen UR in the past is what brought R&D start-ups together and past or current contacts together. A history of old networks and memories of the campus and university is what stuck to the minds of the R&D start-ups that have employees who have had a historical connection to the Wageningen UR campus. From this finding it could be concluded that the Wageningen UR campus' 'real value' for R&D start-ups is more a mix of old memories, experiences, connections to that place in combination with the positive image the campus has towards the outside world (nowadays especially on international level). Even when (especially on campus) R&D start-ups expected to be benefitting more from other campus specific (hard) location factors, they still remained located on campus and took their situation for granted. Therefore, a better definition of a campus could be: *'An attractive physical environment with stakeholders sharing and building on a common narrative'.* Whether the narrative is built on actually having a lot of spillover opportunities or facilities or merely being situated in close proximity to the campus, it still builds on the collective narrative due to unexpected events and memorable experiences.

Another point of view to the perceptual side of the Wageningen UR campus and the campus theory, is that being located on campus also changes the perception of reality of that person (Buursink, 1991). Therefore, being located in a certain surrounding influencing your perception of what determines or had determined your location choice to begin with.

R&D start-ups, that come to the campus, are often young and more receptive and therefore more malleable and accepting towards external influences (Traugott, 1989). When someone keeps telling the R&D start-up that the vicinity of a company (for instance) is beneficial for your small business, but the young R&D start-up has have never actually experienced the benefits of that larger company

in its vicinity before, Those young R&D start-ups opinion may be more influencable by external factors (Traugott, 1989).

- This thesis concluded that the **Knowledge hub theory** (AWTI, 2014) production environment and its specific location factors does fit with the Wageningen UR campus from the R&D start-up point of view, because presence of knowledge is rated the highest overall. An important distinction to this aspects lays in the nature of the use of presence of knowledge. The results from this thesis also show that R&D start-up founded on campus territory favor agglomerate specific location factors more than R&D start-ups located further away. This might indicate that the perceptual image within the minds of R&D start-ups located further away already differentiates with R&D start-ups that are located/founded on campus. The influence could also be that R&D start-ups are more dependent on external support and might otherwise not have started the R&D start-up in the first place. Maybe, incubation programs and influence of third parties on campus opened up doorways for other actors but unnoticeably affect the overall image of the campus and the perception of those who are situated on that campus. The question is whether the addition of, for instance, larger companies and diversity will influences not only the spatial aspects of that campus but also the institutional side of the campus in a Rubicon direction? For whom is this addition desirable and for who is it less desirable? One should look from the societal perspective in regard to the overall added value, as this is the ultimate perspective (economic prosperity vs. quality of life). Is there a spatial and institutional 'sweet spot' for the Wageningen UR campus? This thesis' results would recommend (also see chapter 7) to keep the image of the campus clear to outsiders (see section 4.2.1, section 4.2.6 and appendix 8). This means that the image that is communicated through the use of 'open green spaces' and the 'knowledge core' (AWTI, 2014) of the Wageningen UR campus is still the campus' unique selling point. Any agglomerate specific location factor alterations might distort this image or make other aspects of the campus less attractive. An example is in London Tech City where a cluster of a wide range of digital companies, have raised the ground prices to such an extent that it became uninteresting for some starting ventures to settle there, see chapter 2.4 'Aspects of the Knowledge hub' (Nathan et al., 2012).

- **Spatial proximity** is important for those R&D start-ups that rely on close proximity between certain facilities; think of easy access to laboratories by using a bicycle for transportation. Other R&D start-ups might be mis-/disinformed on other options, because they look within the boundaries of the campus and are not looking outside the region for instance other forms of venture support, see chapter 4.2.2. The Wageningen UR campus communicates that the campus has the capacity to support all types of Agro-Food R&D start-ups (Breukink and Buitenhuis, 2013) and this gives the impression that R&D start-ups do not have to look outside the region (especially the newly formed R&D start-ups), see chapter 4.2.2 'venture support' for instance.

Figure 15: Plus Ultra building containing independent (well developed) R&D start-ups and other sorts of companies related to the Agro Food sector and Wageningen UR (Author's own work, 2016).

These results do show that geographical does affect the valuation of most location factors provided by the campus. Also, there seems to be a sense of place, where spatial features on campus and within the building become apparent for R&D start-ups at the moment they move to the campus (like meeting spots/opportunities). R&D start-ups see the potential in certain aspects of the campus e.g. meeting spots. Besides the actual utilization of these assets by R&D start-ups (because of its close proximity), it does not mean that it is actually utilized.

Often, a common perception of those spatial assets (meeting spots) attracts other R&D start-ups and stakeholders to that area (that might also not use the same assets that are within its vicinity). R&D start-ups hardly collaborate with each other, even when they are situated in the same building (chapter 4 'Results'), though R&D start-ups located in the plus Ultra building (see figure 15) are much more open for interaction with other stakeholders (even students and graduates). For some reason, geographical proximity with interaction-inviting-features and vicinity of other R&D start-ups and actors does not necessarily make interaction an apparent effect, but may be more beneficial in supporting the image of the Wageningen UR campus (Weterings, 2006; Amelink, 2003). There seems to be a mismatch between proximity, the expected benefits, trust and miscommunication (Van Winden en Pol, 2007). This means that geographical proximity to one another in Wageningen UR is not the main reason for interaction and synergy creation in particular, but plays a more fundamental role to the R&D start-up's perception of place-making (Nathan et al., 2012).

- **Wageningen UR, the Agro-Food Knowledge Hub**

As mentioned in chapter 2.4 'Aspects of the Knowledge hub', a Knowledge Hub cluster is a "*geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standards agencies, trade associations) in a particular field that compete but also cooperate*." (Porter, 2000, p. 15). This thesis findings in regard to cluster specific location factors investigated (see chapter 2.4);

Expected benefits of a Knowledge Hub (Dagevos, 2011).	Actual motive in location choice R&D start-ups of this research (++, 0 , --)
1. **Specialized/ qualified personnel**	++
2. **Slimming of labor market**	0
3. **Stimulating competition**	--
4. **Supply/delivery market benefits**	--
5. **Resource acquisition structures** (venture support, facilities)	+
6. **Knowledge/ technological spillovers**	-

Table 20: This table shows the extent to which the expected 'Knowledge Hub cluster related benefits' are part of the motivation of R&D start-ups in their location choice based on overall general score from all investigated proximity ranges.

Of table 20, the: '++', '0' (neutral) or '-/--'' indicates the extent to which the location choice was valuated by R&D start-up on average of all proximity ranges together. The results show the valuation of presence of knowledge is mainly related to the image of Wageningen UR campus. Besides that, vicinity of highly educated personnel also is an important addition location factor. Part of resource acquisition structures are venture support and use of facilities.

This means that only two of the six aspects of the Knowledge Hub cluster concept were motivators in the location choice of R&D start-ups. All location factors except 'use of facilities' are connected to geographical proximity. This shows that the **cluster** in which the R&D start-up is located is much larger than the Wageningen UR campus and its surroundings. The market and competition stimulation is mostly internationally orientated. Also, supply and resource acquisition can be acquired from places outside the region (e.g. Utrecht, Leiden). Different aspects of the 'Knowledge Hub cluster' are spread on various scales (local, regional, national and international). These R&D start-ups are not dependent on the regional Knowledge Hub for its 'expected benefits', but R&D

start-ups mostly want to be associated with a local/regional 'Knowledge Hub' for its image. These R&D start-ups only mild motivation to utilize all the 'expected benefits for companies' of the cluster. The cluster principle is therefore differently applied to R&D start-ups than to other types of companies. R&D start-ups of the Agro-Food sector are very fluid and dependent on the international market. These R&D start-ups hope to interact with other stakeholders through interaction opportunities (meetings) and care more about their connection with the image of Wageningen UR than what their surroundings looks like (density vs open green space). This means that also the **agglomerate** related location factors therefore do not play as much of an important part in the location choice for R&D start-ups in the Agro-Food sector. The aspect of agglomeration those R&D start-ups value more than others is: meeting spots/opportunities. The reason why these R&D start-ups value meeting spots/opportunities is because it may connect them with stakeholders that can aid their business in unexpected ways. All the other aspects of agglomeration (density, diversity of activities, co-location) are less interesting for R&D start-ups. The agglomerate concept therefore applies to R&D start-ups in the Agro-Food sector that favor potential interaction opportunities with other stakeholders (by the means: of meeting spots/opportunities). Then again, it can be questioned whether a larger quantity of meeting spots improves spontaneous interaction between those actors, therefore future research regarding this subject is recommended in section 7.1 'Research recommendation'.

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9. Appendices

Appendix 1:

Possible R&D start-up criteria

Firm's general characteristics(Galope, 2014)	Firm's stage and drivers(Robson and Bennett, 2000)(Chan and Lau, 2005)	Firm's independency(Clarysse et al., 2005).	Firm's type of innovator(Clarysse et al., 2005).	Firm's economic situation(Di Gregorio and Shane, 2003)	Firm's focus (Clarysse et al., 2005).
Size, number of employees (Galope, 2014)	Drivers for growth: (self-employment, pursuing former working environment, expansion of business) (Robson and Bennett, 2000)(Chan and Lau, 2005)	Founded or independent (venture capital) (Clarysse et al., 2005)	Firm innovation level(Clarysse et al., 2005)	Forecast time to break even (Di Gregorio and Shane, 2003)	Types: process based (facilitating processes in production), product-based (developing (parts of) end product), service-based (consultant)(Clarysse et al., 2005).
Number of post graduate educated (Galope, 2014) / Academic level (Felsenstein, 1994)	Stage of growth (moment of success): Set-up, settle down& product development, start marketing, start selling (Robson and Bennett, 2000),(Chan and Lau, 2005)	Alliances with university (incubator) or other companies	(Relatively) new market or existing market & established technology and breakthrough technology (Clarysse et al., 2005)	Debt (Di Gregorio and Shane, 2003)	
Workfield (technical/chemical/ medical) (Felsenstein, 1994)		Intensity of university connection (Felsenstein, 1994)		Location of market (local or otherwise) (Di Gregorio and Shane, 2003)	
Age of company(Felsenstein, 1994)					

The 'firm's general characteristics' tell something about the firm's basic details like; number of (post academic) employees, work field, age of the firm and its location.

Besides the general firm's characteristics, the firm is subjected to economic conditions that impact their situation and preferences. These economic conditions are; forecast time to break even, debt and location of market. Debt and time to break even refer to the prospected revenue and initial and continual costs of the firm. This could be of influence, just like the use of venture capital of third parties, in the sense that its budget is directly impacted and might restrain primary goals and thus location preferences. The firms market can also vary. The market can be local, regional but also international or a combination of these three markets. Lastly the firm's focus of operation, just like its work field, distinguishes it from other firms.

In table A the green coloured characteristics are used in the analysis of the results. This selection is based on personal preference. The red coloured classifications are not asked in the written interviews. These are not asked because they seemed the least relevant for the selection. The black coloured classifications are asked in the written interviews but not used directly for the analysis. Figure A below shows the taxonomy for determining the type of start-up by putting the novelty of technology on the y axis and the novelty of the market on the x axis.
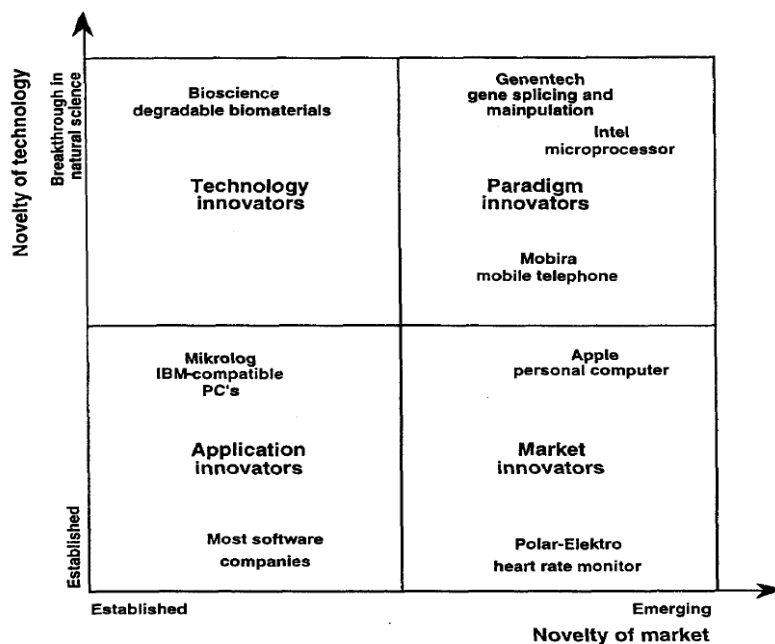

Figure A: Taxonomy of the innovation behaviour of start-ups(Clarysse et al., 2005).

Appendix 2:

Written interview: Agro-food R&D start-ups and the campus

R&D start-up characteristics

1. What is the name of the company?

…Short answer…

2. What is your name and function in the company?

…Short answer…

3. What does the company do?

…Short answer…

4. What type of company is it?

◊ Independent company

◊ spin-off

◊ daughter company

◊ other…

5. Where and when was the company founded?

…Short answer…

6. When did you move to this location

…Short answer…

7. What is your relative distance to the campus

◊ On campus

◊ 0-2 km

◊ 2-5 km

◊ >5 km

8. Did your company made use of an incubation program

◊ Yes

◊ No

9. In what phase is your company in?

◊ Set-up

◊ Product/service development

◊ Beginning of marketing of product/service

◊ Selling of product/service

◊ Other…

10. How well is your company connected to the university?

◊ Barely

◊ Average

◊ Good

11. What type of market does your company have?

◊ New market

◊ Old market

12. Which type of technology does your company use?

◊ Established technology

◊ New technology

◊ A combination of both

13. Where is your market mainly located?

◊ Local

◊ Regional

◊ International

◊ Other…

14. Wat is your company's focus

◊ Production

◊ Product improvement

◊ (Product) process improvement

◊ Service provision

◊ Other…

Location factors

15. Presence of knowledge on campus (university or other companies)

Very unimportant   1◊ 2◊ 3◊ 4◊ 5◊   Very important

16. Venture support (venture capital, rent price, personnel)

Very unimportant   1◊ 2◊ 3◊ 4◊ 5◊   Very important

17. Use of facilities on campus (Lab, IT, restaurant)

Very unimportant   1◊ 2◊ 3◊ 4◊ 5◊   Very important

18. Vicinity of customers and suppliers (contract, control)

Very unimportant   1◊ 2◊ 3◊ 4◊ 5◊   Very important

19. Presence of highly educated personnel (quality, choice and price)

Very unimportant   1◊ 2◊ 3◊ 4◊ 5◊   Very important

20. Meeting opportunities on campus (events, meeting spots)

Very unimportant   1◊ 2◊ 3◊ 4◊ 5◊   Very important

21. The green environment and space between buildings

Very unimportant   1◊ 2◊ 3◊ 4◊ 5◊   Very important

22. Diversity of 'lively' activities in the vicinity of the company (shops, restaurants, cafés)

Very unimportant   1◊ 2◊ 3◊ 4◊ 5◊   Very important

23. Large Agro-Food company in the proximity (related to your company)

Very unimportant   1◊ 2◊ 3◊ 4◊ 5◊   Very important

Appendix 3:

Face-to-face interview: R&D start-ups and the campus

Ivo Brandenburg

(At the beginning ask if the interviewee objects to the use of a digital recording device.)

This interview will last approximately 30 minutes and the organization-related information in the interview remains confidential.

1. Introduction

Interviewer:

Ivo van Brandenburg, graduate research at Wageningen University Master Urban environmental management.

Focus:

The focus of this research Agro-food R & D start-ups within the framework of campus development in the Netherlands. It is questionable whether the ideas surrounding the campus concept meets the needs of R & D start-ups in the agrifood sector.

Interviewee:

1. What is your name and position within the organization?
2. What are the activities of your organization?
3. Focus your organization on specific start-ups?

2. Classification

Introduction:

Beside location factor preferences of R&D start-ups, this study, first seeks to provide an overview of heterogeneity of R&D Agrofood start-ups located around the campus. Through the following five criteria (portrayed below) we can set up a ranking within the diverse group of start-ups. These criteria are:

♣ Phase of the company (establishment, product / service development, early commercialization of product / service, sales of product / service)
♣ Commitment to the university (barely, average, good)
♣ Innovation level of the company (new market, old market - established technology, new technology)
♣ Establishment of the market (local, regional, national, international)
♣ Focus on the startup (production, product (process), service based)
question:
4. In addition to the aspects mentioned above, which other aspects of R&D start-ups are of interest

to policy makers, or which aspects above are more important than the others?

3. Location Factors / production environment

Introduction:

There are a large number of location factors that provide the region and the campus.
To what extent this location factors for businesses of interest; is therefore questionable.

Questions:

5. To what extent is accessibility important for a startup in the AgroFood sector?
6. To what extent is the presence of knowledge of the campus for a startup of interest? (Or is the affordable rent more important for instance?)
7. To what extent do you think the entrepreneurial environment for start-ups is to their liking?
8. What could be better / different?

9. Are any location factors for R&D start-ups becoming more important over time and vice versa; have some location factors become less important than others? And why is that?
10. Did this influence their preferences for an innovative over an entrepreneurial climate over time?
11. Do R&D start-ups ever experience difficulties/obstructions with third parties? (e.g. University, suppliers)

4. Cluster perspective

Introduction:

The cluster (Food Valley) and the campus contain various companies and services which are to certain extent connected with each other.

Questions:

12. Do R&D start-ups mainly utilize knowledge, facilities or certain services from the region or also from other regions?
13. Do R&D start-ups work together to enable innovation?
14. Does potentially attracting future employees from the region/campus play a role for start-ups situating in/around that region/campus?

5. Agglomeration Perspective

Introduction:
The creative cluster 'Amsterdam' has a high diversity and density of related-and unrelated companies (such as stores, large/small businesses and public meeting places). In contrast, the technical cluster Eindhoven commensurate more specialized companies and facilities with much distance and green open spaces. In the course of time more-and-more small-and large businesses and facilities localize

around the campus of Wageningen.

Questions:

15. What impact do you think the construction of several large companies, start-ups and shops close to your company have on the company's performance? To what extent does replacing of open spaces play a role for start-ups?
16. Do you prefer to see specialized companies separated from other companies?
17.Do R&D start-ups prefer being located nearby or rather far off from a larger company?

Figure 1: Campus creative cluster: 'Amsterdam' (left). Campus technical cluster: 'Eindhoven' (right).

Closing:

For this study, it is interesting to get as much R&D start-up input as possible. Besides the face-to-face interviews, written interviews are sent around as well

18. Do you happen to know other Agro-food R&D start-ups around?
19. Do you have any further questions?
20. Are you interested in receiving the final report in August 2016?

Thank you for participating with this research!

Appendix 4

Chances for three types of hotspots

Wetenschappelijk gedreven hotspots

De publieke kennisinstelling biedt verschillende mogelijkheden als aangrijpingspunt voor stimuleringsbeleid. Hoofdstuk 4 staat hier uitgebreid bij stil. De belangrijkste uitdagingen en kansen voor wetenschappelijke hotspots zijn gelegen in het aantrekken en koesteren van wetenschappelijke sterren. Tegelijkertijd dienen ze te voorkomen dat zij vastlopen in verouderde paradigma's, onder andere door het blijven aantrekken en vasthouden van nieuwkomers. De overheid kan daarbij helpen. Daarnaast kan ze bijdragen aan het verbeteren van doorgroeimogelijkheden voor *startups*, het belangrijkste product van dit type hotspot, en kan ze het aanpakken van maatschappelijke uitdagingen stimuleren. Dat is van groot belang, ook omdat daardoor de waarde van de hotspot de directe economische opbrengsten overstijgt (zie ook KNAW, 2013).

Engineering hotspots

Engineering hotspots kunnen krachtige 'innovatiemachines' zijn, sterke ketens van bedrijven en kennisinstellingen die samen tot open innovatie komen, die krachtige verbindingen met elkaar onderhouden en open staan voor signalen uit de wijde wereld. Daar liggen ook de uitdagingen. Vooral in engineering hotspots kan de keten té sterk zijn en leiden tot *lock-in* en verlies van *global pipelines*. Open innovatie is geen gegeven in sterke ketens. Bedrijven zijn ook elkaars concurrenten.

Ze zoeken naar een evenwicht tussen openheid en samenwerking enerzijds en exclusiviteit en eigen voordeel anderzijds. De rol van de overheden is bij deze soort hotspot soms minder pregnant dan bij de creatieve urbane hotspot. De drijvende kracht komt uit de bedrijven.

Een uitdaging, maar ook een kans, is de betrokkenheid van het mkb. Immers, vaak zijn er grote verschillen in machtspositie binnen de keten. Mkb-bedrijven kunnen te maken krijgen met machtsvertoon van grote bedrijven. In goed functionerende engineering hotspots is er echter (ruimte voor) een actieve en vanzelfsprekende rol van het mkb, dat samen met één of meerdere grote bedrijven de ruggengraat van de keten vormt. De focus is daarbij op gedeelde belangen, maar ook op een gedeelde cultuur en taal, waardoor bedrijven, kenniswerkers en kennisinstellingen elkaar snel vinden en via de *buzz* snel van relevante informatie op de hoogte zijn. Verschillen in sector, soort

Creatieve urbane hotspots

Beleidsmakers omarmen de creatieve stedelijke hotspots in heel Europa en de Verenigde Staten als beloftevolle kansen op groeien, als een katalysator voor stedelijk herstel, en met sociale doelen (zoals *inclusive growth*) voor ogen. Vaak gaat dit gepaard met een substantiële publieke bijdrage aan de hotspot. De stedelijke omgeving geeft de hotspot energie, maar maakt de ontwikkeling lastig, aldus van Winden (2011). De lokale overheid is de logische samenwerkingspartner voor de ontwikkeling van dit type hotspot. De overheidsinzet wordt bepaald door de grote hoeveelheid *stakeholders* met een belang bij de ontwikkeling ervan. Een belangrijke uitdaging en kans voor stedelijke overheden is om de verschillende en soms conflicterende belangen te managen en uiteindelijk ervoor te zorgen dat de hotspot zich duurzaam integreert in de stad (zie kader).

Voor het eerst in de geschiedenis is de stad de dominante menselijke habitat, de plaats waar onze toekomst zich zal afspelen. De stad is daarom *de* plek waar de mondiale maatschappelijke uitdagingen zich manifesteren rond armoede, gezondheid, water, voedsel, energie, transport, milieu en klimaatverandering, maar ook rond innovatie en economische groei, aldus MIT (2014). Steden worden complexer, minder gecentraliseerd en veel groter. Ze bieden daardoor kansen als interessante bronnen van *big data*, maar ook voor grootschalige toepassing van nieuwe en duurzame materialen. Ten slotte zijn steden ook relatief vaak gelegen aan de kust, waardoor ze veel baat hebben bij technische, organisatorische en sociale innovaties in kustverdediging en klimaatadaptatie.

De maatschappelijke uitdagingen zijn voor een groot deel een negatief gevolg van verstedelijking, maar de schaal van verstedelijkte gebieden biedt ook het kader voor lagere kosten en een groter innovatievermogen die het gevolg zijn van de concentratie van kennis en kunde. Vanwege de specifieke lokale behoeften en het vermogen oplossingen op de juiste schaal te bieden zijn grootstedelijke gebieden als vanzelf *lead markets* (Wintjes et.al., 2013). Een urbane hotspot is een ideale proeftuin voor allerlei vormen van innovaties gerelateerd aan (verduurzaming van) gemeenschappelijke voorzieningen als energievoorziening, waterbeheer, verkeer en vervoer, klimaatadaptatie en zorg.

Appendix 5

Interesting observations in a nutshell

<u>Proximity ranges:</u>   [0, 0-2, 2-5, >5]

- Venture support is low 'on campus' (2.5 vs 4.4, 4.2, 4.2)
- Presence of knowledge is low 'on campus'   (3.4, 4.4, 4.2, 4.2)
- Use of facilities is 3.4 almost on every proximity (3.4)
- Customer suppliers rated high 'on campus' and high >5 km (4.7, 3.6, 2.6, 3.1)
- Highly educated personnel is relatively low 'on campus' but high elsewhere (3.7, 4.5, 4.2, 4.0)
- Diversity is relatively high at 0-2 km range (3.2, 3.8, 3.0, 2.5)
- Meeting spots is rated high 'on campus' (4.5, 4.1, 3.3, 3.1)
- Open green space a little bit important at 'on campus' and > 5 km (3.5, 2.9, 2.7, 3.4)
- Co-location only a little bit important by 'on campus' (3.5, 2.2, 2.6, 2.8, 2.5)

Appendix 6

Extra in-field photos taken 1

Figure x: The R&D Start-up building on the west side of the Kortenoord Allee near the Agro-business park.

Figure x: Picture taken of Starthub meeting hall. Student chair: of Starthub 'Lepe Bouw' is positioned on the left side of the picture.

Figure x: One of the student offices of Startlife (Starthub).

Figure x: An different angle of the R&D start-up building on the west side of the Kortenoord Allee near the Agro-business park.

Figure x: The Friesland Campina laboratory building (picture taken from the east-window of the Plus Ultra building on the first floor.

Appendix 7

Extra in-field photos taken 2

Figure x: Picture taken from the stairs of the Plus Ultra building looking down on employees of one of the few start-ups located on the ground floor.

Figure x: The R&D start-up company 'NutriLeads' shares information about the company and other news facts on the monitors scattered around the Plus Ultra start-up building.

Figure x: View of the front side of the R&D start-up building of Startlife (Starthub)
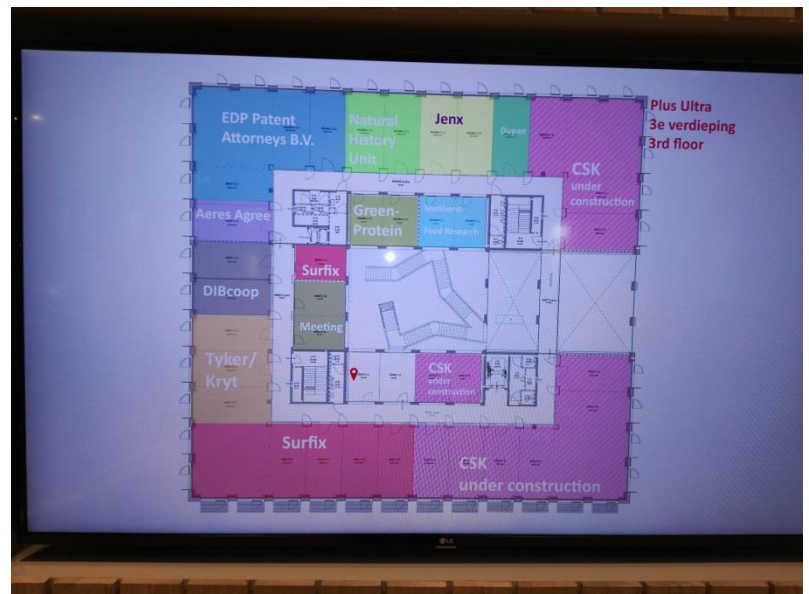

Figure x: One of the monitors located in the common hallway of Plus Ultra building on the third floor shows which companies occupy the floor and which rooms are under construction.