The growth dynamic and assets of knowledge locations

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Abstract

To create an economically successful city and/or region, a knowledge-based economy could be the underlying mechanism to fulfil this goal. To put this type of economy into practice, policymakers focus on knowledge locations. The question that rises is whether firms on geographically defined knowledge locations have stronger employment growth compared to firms at other locations. The outcomes in this research show that knowledge location based firms do not have stronger employment growth than firms somewhere else. However, it's suggested that firms on knowledge locations undergo a specific growth dynamic. During economically vital and stable periods, firms on knowledge locations grow faster than firms located elsewhere, but during economic downturn periods, these firms decline faster than firms at other locations. To establish a knowledge location, it has been examined which type of assets (economic, physical and/or networking) and their elements are required to let the knowledge location be successful. The results indicate that physical elements, consumer amenities and local networking apart from each other foster stronger employment growth for firms at knowledge locations. A combination of these assets show that only physical elements and consumer amenities contribute to the strength of knowledge locations, which could suggest that knowledge locations foster higher employment growth due to the increased quality of working conditions and environment.

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1. Introduction

Many regions and cities strive to have a competitive edge and seek for success formulas to make them economically vital and stable. To fulfil the goal of a vital regional economy, policymakers often coin the phrase "knowledge-based economy" in policy documents, which is defined by the OECD as *"economies which are directly based on the production, distribution and use of knowledge and information (OECD, 1996). A knowledge-based economy is a base for economic growth by commercially using and transforming "knowledge" into products and processes"* (Mueller, 2006).

In the functioning of a knowledge-based economy, two determinants emerge, namely economies of agglomeration and geographic proximity (Audretsch, 1998). Economies of agglomeration suggest that if firms co-locate, they can gain benefits from each other's presence. In other words, geographic proximity is a factor of economies of agglomeration. Agglomeration economies can be divided into four sources; internal increasing returns to scale, localization economies, urbanization economies and Jacobs externalities. The last three sources are the driving forces that make economies of agglomeration an important determinant for a knowledge-based economy (Frenken, Van Oort, & Verburg, 2007).

Localization economies are focused on the "Marshallian externalities", which means that the productivity of labour in a particular sector and city/region will increase when the total employment in that same sector also increases. These "Marshallian externalities" originate from three driving forces, namely labour market pooling, specialized suppliers and knowledge spill overs. The third source, urbanization economies, means that external economies arises from the fact that firms reduce costs by large-scale operations, because of the agglomeration or city/region. These regions/cities, which are populous, attract more easily universities, research centres, trade associations and other knowledge organizations. The dense presence of these firms and organizations together creates an ecosystem where the production and absorption of know-how, stimulates innovative behaviour. In the end, it will result in a contribution to interregional growth. This final part is called "Jacobs externalities", which are derived from a combination of the second and third source of economies of agglomeration (Frenken, Van Oort, & Verburg, 2007). "Jacobs Externalities" bring the knowledge-based economy into practice, with the establishment of knowledge-based development (Knight, 1995). The knowledge-based development concept arose from

the idea that a knowledge-based economy needs a different approach to create a vital economy. A different type of spatial planning/clustering, where various angles of the economy were brought together is the fundament (Maskell, 2001). Etzkowitz and Leydesdorff invented the triple-helix concept, in which the university, industry and government are linked together to drive economic development in a knowledge-based economy (Etzkowitz & Leydesdorff, 1995). Policymakers adapted this concept into their knowledge-based economy approach. In the article of Van Winden (2009), four public actions are identified; 1) the effort to attract knowledge workers, 2) the establishment of knowledge institutions in the spatial planning process, 3) a knowledge-based approach in the urban development of public space and 4) the marketing/branding strategy of cities to show their involvement into the knowledge-based economy. Realizing knowledge locations follows these public actions. Knowledge locations are defined as Knowledge locations are defined as *"geographic areas where (leading-edge) anchor institutions and companies cluster and connect with start-ups, business incubators, accelerators and other institutions in an innovative ecosystem with the aim to foster the establishment, growth and acquisition of knowledge intensive businesses and organizations and their mutual cooperation"* (Katz & Wagner, 2014) (Kooij, Van Assche, & Lagendijk, 2012). A knowledge location can have multiple concepts, such as science parks, knowledge hubs, creative districts, technology parks, buildings on itself, open innovation campuses or innovative districts in dense urban areas. Science park, knowledge hub and innovation district concepts are what most people and academic see as the key example of a knowledge location. The combination of these concepts sets forth three components; real estate development and infrastructure, collective program of activities (network) for knowledge transfer and a corporation between research institutions, government and the private sector (Link, Scott, & Siegel, 2003).

The next question in this introduction is; how to set up a geographically defined knowledge location? In the book of (Van Winden, De Carvalho, Van Tuijl, Van Haaren, & Van Den Berg, Creating Knowledge Locations in Cities, 2010) a theoretical framework is set up with drivers to create a knowledge location. The authors state that the emergence of knowledge locations arises from dynamic processes of governance in which production and innovation systems interact with policy and local planning systems. The production & innovation and policy & planning systems are conceptualized from a spatial economic context. Production &

innovation systems combine a set of economic activities, industries and competences which arise at a particular place over time. It shows the interaction between human action, organized structures and surrounding environment. The policy & planning systems are the systems (government) that are involved with the knowledge location from a legal and legitimacy perspective. The (subnational/local) government can intervene in the regional spatial and strategic planning problems. Together, these systems create collective action to establish a dynamic knowledge location. These drivers are catalysts for creating a knowledge location.

The expected outcomes of knowledge locations are agglomeration & clustering, image, urban-spatial integration and organizational learning. Implementing a combination of different elements can do achieving these goals. In the article of Katz & Wagner, the authors use three types of assets that should be used to actually build a vital and sustainable knowledge location. These are economic, physical and networking assets and should be implemented together (Katz & Wagner, 2014). The assets are originating from the idea how a knowledge location arises and which entities are involved.

An example of a successful knowledge location with the use of the assets, is 22@ district in Barcelona. An important reason for the well-functioning of the district is the high presence of amenities (economic assets). The high level of amenities attracts many knowledge-based firms and is followed by an increasing demand in innovation entities, because of the social interaction between firms (networking assets) (Leon, 2008).

This research studies if the firms on knowledge locations perform better than firms who are located somewhere else by creating an economically vital and innovative environment, which have been set-up by implementing the three types of assets.

The research question is:

To what degree do firms grow faster on geographically defined knowledge locations?

2. Theoretical Framework

2.1. Employment growth on knowledge locations

Do firms on geographically defined knowledge locations have stronger employment growth compared to firms at other locations?

Policymakers, cities and municipalities are intrigued by the term “knowledge locations” and strive for its implementation. One of the reasons why these locations have become an important bullet point on the agenda is the importance of a knowledge-based economy which is linked to knowledge locations. Another factor is the economic development motive for many policymakers. Policymakers push themselves to create new jobs and urban development on specific places (Van Winden, De Carvalho, Van Tuijl, Van Haaren, & Van Den Berg, 2010). With these reasons, case studies of well-known knowledge locations draw attention and can act as reference.

These studies examine knowledge locations in two ways, qualitative and quantitative studies which is a two-split in the overall empirical researches.

2.1.1. Qualitative studies

In Europe, there are a few knowledge locations that have been examined multiple times, such as the Digital Hub in Dublin. This knowledge location has a partly successful story. The success part is the effect on the regional and national economy. The Digital Hub fulfilled to be a good incubator spot where knowledge spillovers are actively managed. The presence of a good labour market, supporting institutions and government programmes contributes to a pleasant environment for entrepreneurs and new firms (Bayliss, 2007).

Problems arise at the economic downturn around 2008. Public-private partnerships were under considerable strains and with strict rules for firms and institutions it is not easy to operate a specialized knowledge location (Van Winden, De Carvalho, Van Tuijl, Van Haaren, & Van Den Berg, 2010). Another problem is the wrong focus of the organization that exploits the Digital Hub. The focus was on property development, instead of social development, such as job creation, educational programmes and establishing a community (Bayliss, 2007).

The Eindhoven Strijp-S area is globally known as one of the most successful knowledge location and is originating from a clear vision and multiple target policies; Stimulus 1993, Horizon 2001 and Brainport Navigator Programme 2013, which attracted many firms and specialized start-ups. Other reasons of the success are; strong triple helix concept, large leading firms acting as anchor institutions (Philips and Bosch), large network to support incubators/accelerators and a good knowledge infrastructure (Pancholi, Yigitcanlar, & Guaralda, 2015).

A case that has a different angle of a knowledge location, is Arabianranta in Helsinki, which focusses on a high level of creative urban regeneration. In this open district where working, living and leisure are combined. The presence of a wide variety of creative firms, the connection with the university and an integral development strategy to stimulate complementary activities in the field of business, housing, shopping, research and education, makes the area very attractive for firms and people (not only knowledge workers) (Van Winden, 2000).

The Singapore One North district is another proper functioning knowledge location, with a good connection on multiple levels, such as transport network and technology network. The knowledge network has a high level of interaction that arises from the guidance of large firms/institutions with small and medium sized firms (Da Cunha & Selada, 2009) (Lim, 2016).

A knowledge location that did not succeed in becoming a successful area is the Malaysia Science Park. The Malaysian policymakers failed to develop a sustainable knowledge location for a few reasons. The first one is that the government funded and supported the park, but the private parties were inadequate with their contribution. The other reasons are that Malaysia lacked the right type of knowledge workers and the actual location of the park made it difficult to attract people. The last reason is the lack of demand for the type of cluster (biotech) (Baily & Montalbano, 2018).

2.1.2. Quantitative studies

The ‘success’ cases stated that the knowledge locations attract many firms and knowledge workers and are creating a vibrant innovative ecosystem within the location, but they do not investigate if these firms actually perform better/worse than firms outside these areas. Besides this, literature on knowledge locations, as indicated above, describes qualitative

cases and most of them with a positive outcome. The popularity of the literature stems from the increased interest and urgency about the establishment of a knowledge-based economy. Besides these qualitative 'success' studies, there is a lack of quantitative (case) studies about the performance of knowledge locations and the firms that deal with it. The available quantitative studies are about productivity, job creation, clustering and R&D and show most of the time positive results. A quantitative study in Sweden, showed that new technology-based firms (NTBFs) present at science parks, had a significantly higher level of job creation that NTBFs in general (Löfsten & Lindelöf, 2002) . In addition to Strijp-S in Eindhoven, the 22@ Barcelona case is a famous case of knowledge locations. Since its start, this knowledge location has a constant increase of innovation & knowledge firms as well as an increase in the skill level of human capital. Another important effect of this knowledge location is the growth in output of R&D activities. These effects are compared with firms that are outside the 22@ Barcelona district (Viladecans-Marsal & Arauzo-Carod, 2012). In the United Kingdom, researchers revealed that firms on university science parks had a higher research productivity level than firms outside these parks (Siegel, Westhead, & Wright, 2003). In an article about industrial districts in the Italian region Lombardy, the authors found empirical evidence that firms in these districts perform better on innovation activities compared to firms outside the areas (Muscio, 2006).

Another study in Sweden found neither negative nor positive effect of university spin-offs (USOs) on patent output. The outcome was that these firms on science parks were not able to create a larger R&D (patents) output with the investments that they received, drawing the conclusion that science parks are not an effective way to increase the level of innovation (Löfsten & Lindelöf, 2005).

The outcomes of quantitative and qualitative studies are pushed into a positive direction for knowledge locations, but since there is a lack of quantitative studies that investigate the performance of firms on knowledge locations compared to firms that are not on these locations, a strong conclusion cannot be made.

2.2. Three types of Assets

The base of the knowledge locations is a knowledge-based economy, as described in the introduction. Policymakers wish to organize the exchange of knowledge between firms and/or people by creating a geographically defined area. Knowledge locations need one critical element to arrange the proper performing of the knowledge exchange, namely open innovation. Open innovation can be defined as *"societies and companies that compete on innovation and trying to implement external innovation"*. The exchange of information to establish a higher level of innovation is where many people and firms are looking for. This open innovation is on itself a component and together with three categories of assets and a culture where a risk-taking mind is leading, an innovative ecosystem can be created (Teirlinck & Spithoven, 2008). An innovative ecosystem can be defined as *"a system where there is a relationship between firms, people and a place that creates idea generation and, is an accelerator for commercialization with a synergetic effect"* (Doloreux, 2002).

This innovative ecosystem is the start of making knowledge locations vital, sustainable and innovative. The three categories of assets are the elements that are necessary in driving the location making them productive and well-doing. These categories are economic, physical and networking assets. The general importance in the use of these assets is that they all should be integrated into these knowledge locations. If locations have high levels of economic and physical assets, but lack networking assets, then this could have consequences for creating a 'successful' knowledge location. (Katz & Wagner, 2014).

2.2.1. Economic assets

Do knowledge locations with stronger economic assets foster stronger employment growth of firms on geographically defined knowledge locations?

2.2.1.1. Innovation drivers

Type of firms

To create a knowledge location, it is important to have a variety of firms. During the early days of knowledge locations, policymakers were convinced that high-tech (innovative) firms were the solely type of firms that were needed. Over the years, this perception changed with the attraction of creative firms. The creative industry and their firms are important for three reasons. Firstly, they are contributing to the creation of innovative ideas and to the level of innovation of the locations. Secondly, the services of creative firms are a catalyst for the innovation of other firms around them. The last reason is that creative firms are important users of technology and demand adaptations or new products, which gave an impulse to the level of innovation (Müller, Rammer, & Trüby, 2008).

The second requirement in the type of firms is the high-value firm, such as a high-technology and/or bioscience firm. These firms invest large amounts of money into research and development (R&D) and this is important since R&D contributes to the establishment of relationships with universities that is another important element in economic assets (Laursen & Salter, 2004).

Another type of firm belonging to knowledge locations, is the software firm, which makes applications for smartphones/computers, etc. The importance of these software firms can be found in the field of economic development. The rise of smartphones, tablets and social media increases the demand for people to create content for these electronics and platforms. Policymakers happily welcome the firms for generating employment. (Mandel, 2012).

The last group is the highly-specialized firm, an important driver of innovation and growth. This category forms a large base for high-skilled knowledge workers. The location and density of highly-specialized firms on knowledge locations allows quick responds on changing needs in the market; local, regional or global (Mistry & Byron, 2011).

On a knowledge location one or multiple firms should claim a leading role. These leader firm(s) encourage innovation, enable internationalization of other firms on the knowledge location and increase the skilled knowledge pool (Nijdam & De Langen, 2003). A leader firm is a catalyst that brings the spark to the knowledge location and starts the whole chain of a vital, sustainable, on-going knowledge location.

Diversification or specialization?

The type of firms that have been discussed above, raises the next question; specialization or diversification? Should the firms operate with their economic activities in the same (niche) sector or is operating in different markets better for the firms and the knowledge location on itself? To answer this question, a definition of clustering should be given. Clustering is: *"a cluster of independent and informally linked companies and institutions represents a robust organizational form that offers advantages in efficiency, effectiveness, and flexibility"* (Porter, 1998). Specialization and diversification both refer to clustering, but at different ends from the spectrum.

Starting with the firm level analysis, the level of innovation is higher when the economic activities are not focussed on a narrow industry (niche), but are diversified across complementary sectors/industries, which are sharing a common science base. In the case of the outcome for a geographically defined area, such as a knowledge location it is preferred when firms are complementing economic activities in a diversified way with a common science base at the bottom (Feldman & Audretsch, 1998). It should be mentioned that specialization should not be banned from geographically defined areas, but a too high level of specialization (niche sector) won't foster innovation.

Governance

A part of the whole knowledge location is the business knowledge governance mode that is at the top of the structure. Business knowledge governance is defined as "a set of institutions, corporate strategies, types of transactions and forms of interactions that characterize and shape the organization of knowledge production, exchange and usage in the business sector." It's important that an entity is focussed on the architectural and dynamic structure of the knowledge location. This governance should deal with several sorts of activities, such as coordinated transactions, constructed interactions and quasi

hierarchies. The dynamic structure/coordination in knowledge locations is relevant to reduce costs, which is formed by multiple inventions by same firms/entities (Antonelli, 2006).

Entrepreneurship

Entrepreneurship is a driving force of employment and catalyst in the build-up of a cluster. This makes entrepreneurship an important factor for knowledge locations. To let entrepreneurs successfully operate on a knowledge location it is important that these firms can have access to major markets outside these locations/clusters, especially in the early stages (Bathelt, Malmberg, & Maskell, 2004).

The term entrepreneurship has a strong connection with universities. The reason for this is that universities, that form the basis of technology development, could provoke entrepreneurial activity. In this way, referring to the triple-helix concept in which policymakers stimulate universities in having more research activities, entrepreneurship is eventually stimulated. The outcome is that entrepreneurship should be present at knowledge locations to stimulate innovation and to use knowledge spillovers in interaction with universities (Shane, 2004).

2.2.1.2. Universities

Firms focus at all kinds of regional characteristics for their location choice, but universities are becoming a more influential characteristic. The access to knowledge is the main reason why new (high-tech) firms prefer their location close by a university. Research based firms and entrepreneurs wish to have access to high skilled and well-educated students to create new ideas and increase the level of innovation (Audretsch & Lehmann, 2005). The demand by firms to have better access is also pushed on the supply side by the government. The government stimulates universities to go beyond their standard scope and interact more with global commercialization. Their research should be contributing to the wealth creation of firms. Academics (universities), industries (firms) and the government are forming together a triple-helix with ‘start-up firms’ as main outcome. The interaction between the three components is creating innovation and is especially provoked by universities that wish to bring theory into practice.

This triple-helix is important for knowledge locations to attract firms and provide them the necessary knowledge (Etzkowitz & Leydesdorff, 1995). Policymakers could use this triple-helix system in the form of policies by e.g. providing knowledge infrastructure. Another policy could be that policymakers stimulate universities to focus more on research activities by students, and deliver well-educated students directly to these firms (Audretsch & Lehmann, 2005).

2.2.1.3. Innovation cultivators

Innovation cultivators are the firms, organizations, and/or groups that stimulate and support growth of firms, individuals and their ideas. These are incubators, accelerators, proof-of-concept centres, shared working spaces and other supporters of knowledge locations. These cultivators are stimulated by the knowledge-based economy. The specific focus of these cultivators is that they are grouped together on the knowledge location to actively support the innovation drivers, since they play a vital role in economic growth and innovation. They can help entrepreneurs to turn their ideas/products into successful ventures. In the early days of innovative campuses, incubators showed up at firms when they were already in an advanced part of their lifecycle, but nowadays they support firms directly from the start. This is an important factor for knowledge locations. Putting cultivators and driving forces actively together from the start is stimulating the level of innovation (Katz & Wagner, 2014). The incubators that should be attracted to knowledge locations should have several services; access to physical resources, start-up support, and access to financial resources, office support and networks. The accesses to a network and office support are both important assets that can contribute to stimulating employment growth on a knowledge location. The access to network will be linked to the networking assets of this framework (Isabelle, 2013). Venture capitalists is one of the incubators which nowadays co-locate at knowledge locations (Florida & Mellander, 2014). These venture capitalists do not only focus on start-ups/scale-ups/firms, but also closely locate to college graduates and the creative class, which are present at knowledge locations. It seems that knowledge locations are changing the role of cultivators since they are more actively involved in the driving force of innovation, growth and sustainability of firms and the location on itself (Kayakutlu & Mercier-Laurent, 2012).

2.2.1.4. Consumer amenities

Consumer amenities have an economic role on the knowledge location. Amenities provide services to workers and well as to residents. In the case of innovation districts, residents should be playing a more prominent role. These amenities could be restaurants, coffee bars, small hotels and retail shops.

In the article of (Glaeser, Kolko, & Saiz, 2001) the authors state that: “In the next century, as human beings continue to get richer, quality of life will get increasingly critical in determining the attractiveness of particular areas”. Summarizing this statement; amenities as well as the economic and physical assets will play a vital role in the attraction of high-skilled knowledge workers. The well-functioning of amenities can be established by four stages. The first one is a rich variety of services and consumer goods. The next one is the physical setting and aesthetics of amenities. The third critical factor in amenities is good public services like good schools. The last critical factor is speed. Consumers should easily move around with low transportation costs (Glaeser, Kolko, & Saiz, 2001). These critical factors are linked to social interaction, which is a part of the networking asset. Social interaction will have a considerable effect on the overall well-doing of knowledge locations, because people can exchange knowledge within these amenities. This is a part of geography of amenity, where interaction is closely related through geography scale (Hutton, 2004).

Innovation Drivers	Universities	Innovation Cultivators	Consumer Amenities
Creative firms	Link with universities	Active incubators	Restaurants
High-technology firms	Research driven	Active accelerators	Coffee places
Software firm	Access to students for jobs & knowledge	Other institutions that stimulate growth & innovation	Bars (cafés)
Leader firm	Triple-helix concept		Hotels
Highly specialized firm			Retail shops
Governance (architecture)			Good public services
Diversification			
Entrepreneurs			

Table 1 - Categories and elements of economic assets

Source - (Van Winden, De Carvalho, Van Tuijl, Van Haaren, & Van Den Berg, 2010) (Katz & Wagner, 2014) (Etzkowitz & Leydesdorff, 1995) (Glaeser, Kolko, & Saiz, 2001)

According to the literature review, combining the elements together make the category economic assets an important asset in successfully creating a knowledge location. Attracting diverse high-tech and creative firms with leaders, the presence of an architectural structure of the location, links with universities and constructing consumer amenities will contribute to economically vital knowledge location.

2.2.2. Physical assets

Do knowledge locations with stronger physical assets foster stronger employment growth of firms on geographically defined knowledge locations?

2.2.2.1. Amenities & resources

Amenities & resources refer to the physical assets of knowledge locations. These assets could be open to the public, such as parks, plazas and streets. Prepared for the future, public spaces are digitally accessible with open access to the Internet, wireless networks and large digital displays. Another feature of public spaces is that they are created for social interaction. Places where people coincidentally bump into each other and can exchange knowledge and information. Public spaces can also be used for training sessions or events on the knowledge location. These public spaces are integrated in knowledge locations in such a way that a network can be created within the knowledge locations (Joroff, Frenchman, & Rojas, 2009).

Spaces with a private characteristic are mixed-income housing, neighbourhood-serving retail and research/office spaces. Mixed-income housing will particularly be found in innovation districts that are integrated in the urban areas of cities. These research/office spaces are designed to create social interaction with for example flex workspaces, large areas of meeting spots and/or shared facilities (Katz & Wagner, 2014). Another important factor in these spaces is the affordable price of renting. Start-ups normally won't have enough money to rent an expensive office (Florida & Mellander, 2014).

2.2.2.2. Place & building design

The design of knowledge locations is mainly about the level of openness. It is about the feeling to be invited into the geographically defined area. A higher level of openness can be reached by removing fences or other barriers from the area. Linking large (anchor) institutions to the whole knowledge location can be done easier by opening the knowledge location. These institutions often have their own campus and are isolated from the larger area. Eventually, the design eventually will interact with the connection factor by development of open spaces, bike paths and sidewalks.

Focusing on the architectural design of the knowledge location. Public or private spaces that are designed with a high level of architectural quality and sustainability will attract people to the knowledge location from an image perspective. Working, living and socially interact in a beautiful and sustainable environment is becoming more important for people (Ragheb, El-shimy, & Ragheb, 2016).

2.2.2.3. Connectivity

Connectivity is about the connecting elements of the knowledge locations. This could be the public transport system, but also bike paths, sidewalks and public open spaces. These elements are neutral connectors for the knowledge location itself as well as the connection with a larger geographical area. Connectivity is also about accessibility (Katz & Wagner, 2014). The ease with which people can move between places. If knowledge locations are not easily accessible, it will create a barrier for workers and consumers that in the end probably will result in a negative spiral of the knowledge locations (Van Winden, De Carvalho, Van Tuijl, Van Haaren, & Van Den Berg, 2010).

2.2.2.4. Image

The image of a knowledge location refers to the attractiveness and the reputation (Pluijmen, 2017). The interaction with design is about the architectural design of buildings in the area, but also about the openness. In the article by Hospers, the author refers to Kevin Lynch, who discusses critical elements of a city to create an imaginable city where one of these elements is locations. Every location should have its own feeling and distinctive character to distinguish itself from the rest and creating the right image (Hospers, 2009).

With the presence of many different amenities and resources, the quality of life will increase, which influences the attractiveness of a knowledge location (Katz & Wagner, 2014). Another element of image is the media coverage of knowledge location, which will most probably be positive and will have its effect on the knowledge location on itself (creating attractiveness) and the identities located there (Pluijmen, 2017).

Amenities & Resources	Place & Building Design	Connectivity	Image
Flexible facilities	Design of built environment, in terms of being invited and welcomed to the knowledge location	Diversity of infrastructure	Uniqueness of identity, mental mapping
Access to various	Modularity, standardization and openness of buildings	Pedestrian oriented infrastructure	Quality of place (attractiveness)
amenities/functions		Public transportation	Reputation (media coverage)
Public & semi-public meeting and working spots		Physical connectors	Uniqueness of identity, mental mapping
Mixed-use buildings		Connecting knowledge location with broader area	Quality of place (attractiveness)
Exhibition space, showrooms		Diversity of infrastructure	Reputation (media coverage)
Shared facilities		Pedestrian oriented infrastructure	
Venues for training & education, cultural events & entertainment		Public transportation	
Small parks & plazas		Physical connectors	
Mixed-income housing		Connecting knowledge location with broader area	
Neighbourhood-serving retail			
Affordable space			
for start-ups			
Digital-accessibility			

Table 2 - Categories and elements of physical assets

Source - (Pluijmen, 2017) (Van Winden, De Carvalho, Van Tuijl, Van Haaren, & Van Den Berg, 2010) (Katz & Wagner, 2014) (Curvelo Magdaniel, 2016)

Amenities & resources, place & building design, connectivity and image are forming together the physical assets. Especially amenities & resources and connectivity are contributing to the physical assets and support power to knowledge locations. From the literature, it is clear that without a good structure of physical assets, the networking and economic assets will not properly be implemented in a knowledge location, facing a possible deterioration of the location.

2.2.3. Networking Assets

Do knowledge locations with stronger networking assets foster stronger employment growth of firms on geographically defined knowledge locations?

Networking assets is about the interaction between people, firms and other institutions on knowledge locations. These interactions can be in the form of exchanging knowledge and information. The importance of networking assets can be found in several ways. Firstly, these assets can contribute to the creation of new products and discoveries. Secondly, they stimulate experimentation and the development of testing grounds for new ideas. The last reason is that networking assets help to acquire resources for firms, strengthen the trust with collaborations across firms and clusters/sectors (Katz & Wagner, 2014). The elements that are important in networking assets are local networking and global networking. Local networking is focussed on the local network within the knowledge location, whereas global networking is about interfirm relations outside the knowledge location.

2.2.3.1. Local networking

Local networking is a factor of clustering that is defined as *"a geographically proximate group of inter-connected companies and associated institutions in a particular field, linked by commonalities and complementarities"*. This means that the connections between firms in the case of a knowledge location are geographically very close. 'Local' refers to the term 'tacit', where tacit knowledge is spatial dependent. A factor that is especially important in linking knowledge locations to local networking is urbanization economics, which gets the label 'buzz'. The term 'buzz" arises from the concept that within the knowledge location a vibrant innovation milieu exists with many local actors involved. The exchange of information and communication via face-to-face contacts, co-presence, co-location of people that is created with physical assets like shared working spaces and meeting spots. The fact that this 'buzz' is created within geographical proximity of many specific firms within a knowledge location is focused on tacit knowledge (Bathelt, Malmberg, & Maskell, 2004). Besides geographical proximity, technological and organizational proximity are other factors that enhance local networking. They both refer to the idea that firms within knowledge locations have similarities on technological and organizational level. This

information is normally very specific and is constantly updated and exchanged with many people (intended, unintended). Especially the unintended knowledge exchange is favourable for the level of innovation, small and medium-sized firms will explicitly benefit from this exchange (Chan, Oerlemans, & Pretorius, 2010). The same cultural traditions, habits within the same technology field and conventions, meetings, workshops arranged by institutions makes the knowledge information easy exchangeable. The role of governance is that it creates events that stimulate local networking (Leon, 2008). Cited from the article of Gertler; "actors continuously contribute to and benefit from the diffusion of information, gossip and news by just 'being there' (Gertler, 1995). This is exactly the key point of what a knowledge location should be about. Knowledge exchange and local networking are elements that should be implemented from the start in the creation of economic and physical assets.

2.2.3.2. Global networking

Global networking refers to the term 'pipelines' which are channels of information, interaction and communication with more distance (outside the knowledge location). The importance of global networking is that new knowledge often arises from strategic partnerships of interregional and international reach. When comparing global networking with local networking, one of the main differences is the factor of trust. In local networking, shared trust is present between multiple firms on the knowledge location, but in the case of global networking there is no shared trust, and should therefore be created. With building a certain level of trust, firms can strategically provide each other useful information. Global and local networking meet each other in the creation of extra-local knowledge flows. If firms of a knowledge location/cluster engage in the build-up of pipelines, more knowledge information flows into the network of the knowledge location and creates a more dynamic buzz, which ultimately benefits the firms in the knowledge location (Bathelt, Malmberg, & Maskell, 2004).

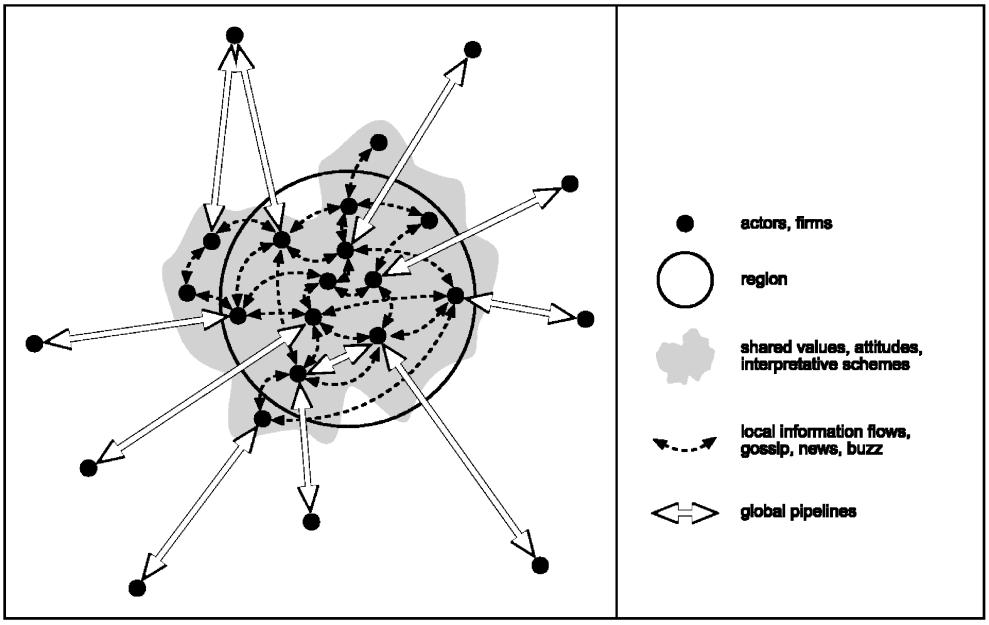


Figure 1 - Structure and the dynamics of local and global networking

Source - (Bathelt, Malmberg, & Maskell, 2004)

Local networking	Global networking
Stimulating local buzz	Strategic partnerships
Meeting spots	Creating high level of trust
Shared-working spaces	Active involvement of firms in the knowledge location with partnerships
Meetings & events	Strategic partnerships
Same cultural traditions & habits of people	

Table 3 - Categories and elements of networking assets

Source - (Bathelt, Malmberg, & Maskell, 2004)

The global pipelines and local buzz together form the networking assets. They are complementing each other to effectively creating a knowledge network where firms and people can exchange tacit knowledge and other types of information. These networking assets are also stimulated via economic and physical assets. The literature is clear that networking assets are needed to create a successful knowledge location where firms perform well compared to firms that are not present at these locations.

3. Conceptual Framework & Hypotheses

3.1. Conceptual framework

From the theoretical framework, a conceptual model has been created which gives an overview of how knowledge locations are established and how they should develop a competitive advantage. Starting the analysis from the bottom, a knowledge-based economy is the catalyst for creating a knowledge location. The demand factor is a (creative) production and innovation entity that strives to develop a product and/or service that makes as a solid business model for the entity. This entity wishes to operate in an innovative ecosystem where it hopes to become a part of an innovation circle that contributes to own daily activities. The steering factor is the policy and local planning entity that wishes to establish a knowledge location with impact on the city/area that serves as a fundament for a local knowledge-based economy. These factors together create a knowledge location. To realize a knowledge location, three types of assets (economic, physical, networking) are needed that should operate in a firm mix. These assets together should create an innovative ecosystem that brings a certain level of innovation into the location and develop a competitive advantage over other (knowledge) locations. The competitive advantage will flow back into the knowledge-based economy and closes the loop of the conceptual model.

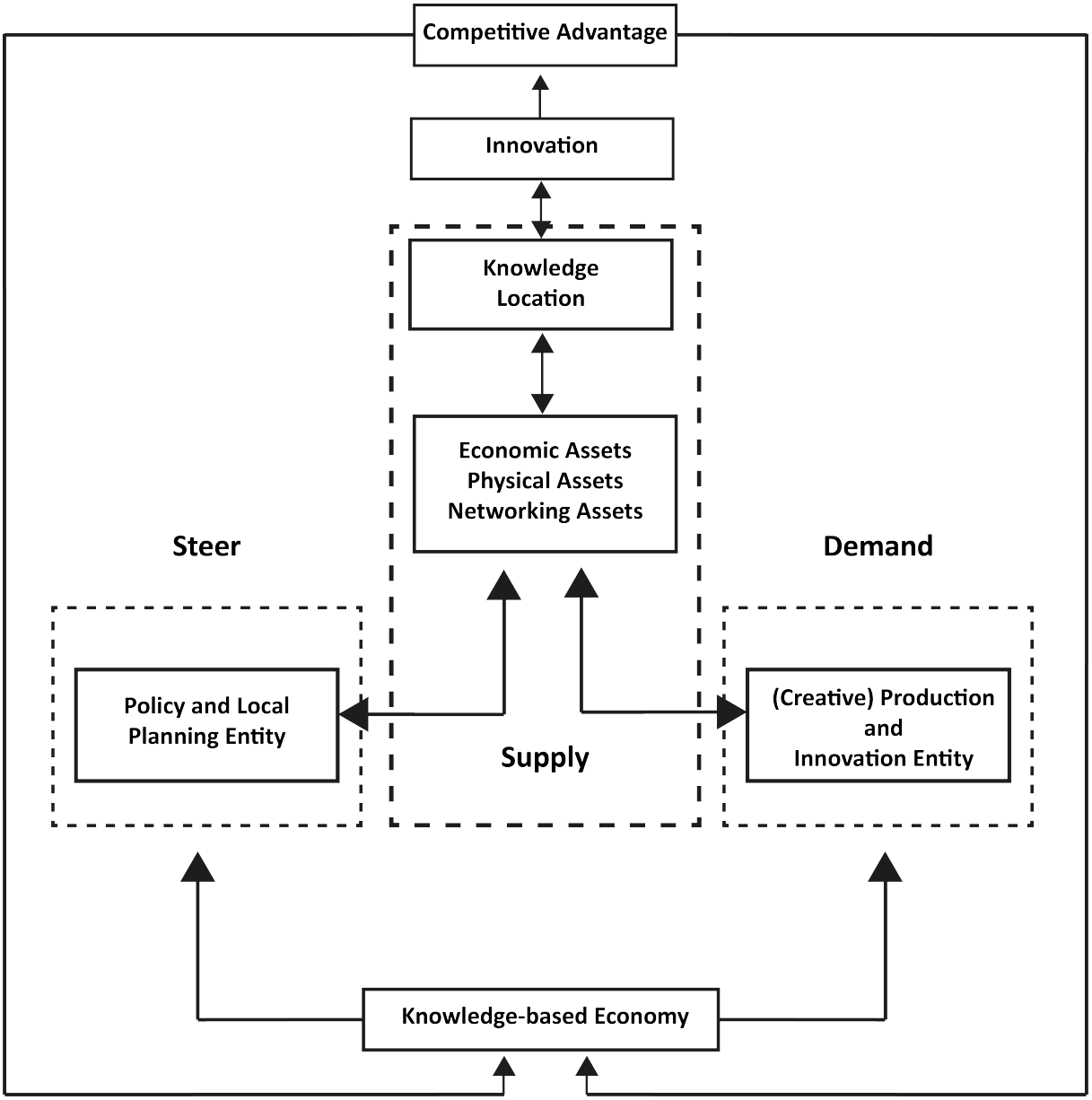


Figure 2 – Conceptual framework knowledge location

Source: own creation with the combination of (Van Winden, De Carvalho, Van Tuijl, Van Haaren, & Van Den Berg, 2010) and (Pluijmen, 2017)

3.2. Hypotheses

With the conceptual model, several hypotheses are derived and examined in the empirical part of this research. The first hypothesis investigates what the employment growth effect is which results from a certain level of innovation and is followed by a creation of competitive advantage. The level of innovation and consequently the competitive advantage of a knowledge location will have a (positive) impact on the business activities of a firm. This will result in a relatively larger increase in employment growth for firms on geographically defined knowledge locations than for firms outside these locations.

Hypothesis 1 – Firms on geographically defined knowledge locations have stronger employment growth compared to firms at other locations

The second till the fifth hypothesis covers the three assets that should be present and mixed in a certain way on a knowledge location. The second hypothesis states that knowledge locations with stronger economics assets create a stronger employment growth for firms that are present at the geographically defined knowledge locations. Economic assets are the driving forces that bring economic supply & demand into the location and they are categorized into four components, namely innovation drivers, universities, innovation cultivators and consumer amenities. With regard to their factors they will contribute to the innovation level on knowledge locations and in the end, competitive advantage.

Hypothesis 2 – Knowledge locations with stronger economic assets foster stronger employment growth of firms on geographically defined knowledge locations

The third hypothesis examines the effect of physical assets on the employment growth of firms on geographically defined knowledge locations. Physical assets are about the actual appearance and physical performance of knowledge locations and are divided into four groups; amenities & resources, place & building design, connectivity and image.

Hypothesis 3 – Knowledge locations with stronger physical assets foster stronger employment growth of firms on geographically defined knowledge locations

The fourth hypothesis deals with the networking assets and their effect on employment growth of firms on geographically defined knowledge locations. Networking assets is about the network of firms inside (local networking) the knowledge locations and off-side (global networking) and how they are established and interact.

Hypothesis 4 – Knowledge locations with stronger networks assets foster stronger employment growth of firms on geographically defined knowledge locations

The fifth hypothesis states that a mix of the three assets should be present at a knowledge location to foster stronger employment growth for firms located on geographically defined knowledge locations compared with firms outside these locations. The most interesting question is; what is the right mix of assets?

Hypothesis 5 – Knowledge locations with a mix of physical, economic and networks assets foster stronger employment growth of firms on geographically defined knowledge locations

4. Data & methodology

4.1. Data description

To analyse the hypothesis and the research question, a panel dataset is used, which has been formed from three other datasets. These datasets concern the geographical locations of the knowledge locations (GIS map), firms in the Netherlands with employment data (LISA dataset) and the data outcome from a survey that has been sent to representatives of all knowledge locations from the GIS Map.

4.1.1. Knowledge location map

The first dataset is a GIS map with the geographical locations of the knowledge locations. To create the knowledge location map, a reference should be made to the definition of a knowledge location in the introduction. Knowledge locations are defined as *"geographic areas where (leading-edge) anchor institutions and companies cluster and connect with start-ups, business incubators, accelerators and other institutions in an innovative ecosystem with the aim to foster the establishment, growth and acquisition of knowledge intensive businesses and organizations and their mutual cooperation"* (Katz & Wagner, 2014) (Kooij, Van Assche, & Lagendijk, 2012).

This definition gives the opportunity to create several criteria in searching and plotting the knowledge locations. The first criterion is physical location. An actual geographically defined area should be present to be considered as a knowledge location.

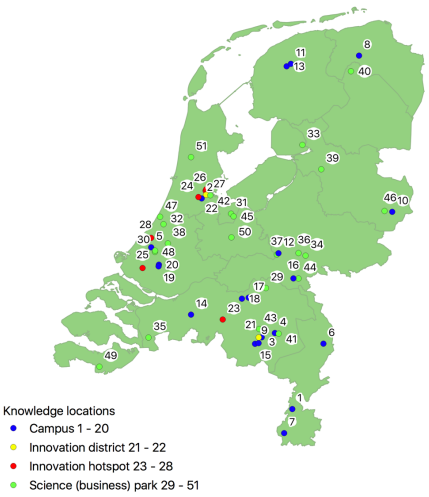
The second criterion is firm establishment and presence of innovation cultivators. On the knowledge locations, firms should be able to locate an office. If this condition is not met, it is not possible to analyse data to answer the hypotheses and research question. Without firm establishment, it's not possible to examine if firms on knowledge locations have a higher employment rate than firms who are not located on these locations. The presence of innovation cultivators refers to the part in the definition of knowledge locations where firms cluster and connect with business incubators, accelerators and other institutions to stimulate innovation and knowledge development. With the innovation cultivators, possible knowledge locations comply with the definition. Both the factors in this criterion can be

tested by investigating publicly information (website) of the knowledge location and address databases with the actual location of firms.

The next criterion is focus on research & development (R&D) and innovation. Firms that are located on knowledge locations should actively focus on R&D and innovation. This can be done by the presence of state of the art establishment options, research facilities and the right type of firms on the knowledge locations. With the right type of firms, it means that the firms operate in an industry where knowledge is an important factor and where there is a demand), such as high-technology. This condition can be verified by screening the website of knowledge locations.

If all conditions are met, a location can be considered as a knowledge location. Fifty-one knowledge locations have been found in the Netherlands and plotted in a GIS map. With the help of websites and publicly known information/maps, the knowledge location polygons are drawn into QGIS (a GIS software program). It is important to mention that many locations who mark themselves as a knowledge location are not always a knowledge location by the definition as indicated above, such as multi-tenant buildings. These buildings propagate as a location with an innovative ecosystem by the interaction between firms, but they do not foster knowledge-based ecosystem. This GIS map is important since it can be merged with the two other datasets (LISA dataset and survey data) and because it is a key factor in answering the hypotheses and research question. The 51 knowledge locations are plotted in the figure below.

Number	Name
1	Brightlands Chemelot Campus
2	VU Campus
3	TU/e Campus
4	Automotive Campus
5	Biotech Campus Delft
6	Brightlands Campus Greenport Venlo
7	Brightlands Maastricht Health Campus
8	Campus Groningen
9	High Tech Campus Eindhoven
10	Kennispark Twente
11	WaterCampus Leeuwarden
12	Wageningen Campus
13	Dairy Campus
14	Triple O Campus
15	Health Innovation Campus
16	Novio Tech Campus
17	SPARK Campus
18	Grow Campus
19	RDM Campus Rotterdam - Rotterdam Makers District
20	M4H Rotterdam - Rotterdam Makers District
21	Strijp-S Eindhoven
22	Knowledge Mile
23	Midpoint Center for Social Innovation Tilburg
24	B. Amsterdam
25	Plant One Rotterdam
26	A LAB



Number	Name
27	De Ceuvel
28	The Hague Security Delta - HSD Campus
29	Pivot Park
30	Delftechpark
31	Hilversum Media Park
32	Leiden Bio Science Park
33	Dyntes Tech Park
34	Industriepark Kleefse Waard
35	Business Park Aviolanda
36	Arnhems Buiten (Energy Business Park)
37	Business & Science Park Wageningen
38	Dutch Innovation Park
39	Polymer Science Park
40	Health Hub Roden
41	Food Tech Brainport
42	Amsterdam Science Park
43	Bedrijvenpark Ekkersrijt
44	Mercator Science Park - BV Campus
45	Werf35
46	High Tech Systems Park
47	Space Business Park
48	TU Delft Science Park
49	Biopark Terneuzen
50	Utrecht Science Park
51	Energy Innovation Park

Figure 3 - Knowledge locations in the Netherlands

Source – own creation with QGIS

All the knowledge locations on the GIS map have been categorized into four groups; campus, science (business) park, innovation hotspot and innovation district.

These categories are covered by the definition of knowledge location, but there are differences between the categories in allocating the knowledge location to the correct category. Not every knowledge location with one of the categories in their name can be assigned to that same category, such as ‘The Hague Security Delta – HSD Campus’ which is actually an innovation hotspot.

A campus focus on R&D, has a high-quality physical location with research facilities, presence of manifest knowledge carriers and stimulates active open innovation between firms and knowledge institutes. Science (business) parks focus more on attracting and locating firms in a commercial sense on their geographically defined area and can be seen as a normal business park with a more innovative ecosystem and the will to promote R&D, innovation and knowledge by also connecting with higher education institutions. Innovation districts are larger geographically defined areas that are not delineated and are forming an important connection with the community in the same area. These districts are part of the urban structures of an area where living and working is interwoven with each other. Innovation hotspots is the category where the knowledge locations end up if they do not fit in the other categories. These knowledge locations can be buildings or very small

geographically defined areas, but these hotspots foster a very strong innovative ecosystem (Buck Consultants International, 2018), (Katz & Wagner, 2014).

4.1.2. LISA dataset

The second dataset is the LISA (Landelijk Informatiesysteem van Arbeidsplaatsen) dataset with the timeframe 2003 – 2015 with 11.787.550 observations. This dataset contains all locations in the Netherlands where paid work is performed, which is displayed by a LISA number in the dataset. The core data per location has a spatial component (address data) and a socio-economic component (employment and economic activity). The importance of this data is justified due to the reason that it shows data about the employment per location for all the firms in the Netherlands and provides detailed data about the location of every firm. This allows, with the use of the GIS map, examination of the firms located on the knowledge locations and to investigate if these knowledge locations based firms have higher employment rates than firms not localized here. Besides these two reasons, the dataset and GIS map can be merged with the data outcome from the survey and offers the opportunity to examine which factors from the three types of assets (economic, physical and networking) are important in successfully creating an economic stable and innovative geographically defined knowledge location. In the section below, the survey data will be further eluded. The dataset also includes variables that can serve as control factors, such as years, size classes, province code and industry type.

SBI code

In the LISA dataset, there are variables included that are called SBI codes 2008. This means in Dutch ‘Standaard Bedrijfsindeling’ and translated in English ‘standard company classification’. The SBI codes use the 2008 standard and are based on the activity classification of the European Union and United Nations. In the theoretical framework, it emerges that a knowledge location is based on a knowledge based economy with entities that are creative and innovative, called knowledge intensive firms (figure 2). This makes it interesting to check whether knowledge intensive firms have different outcomes in the empirical analysis compared to firms in the broad sense. To fulfil this analysis a smaller

dataset has been set-up with the help of SBI codes. A selection of knowledge firms has been made regarding the main classification (2 digits) of SBI codes.

Knowledge intensive industry	Knowledge services
19 - Manufacture of coke and refined petroleum products	22 - Manufacture of rubber and plastic products
20 - Manufacture of chemicals and chemical products	58 - Publishing activities
21 - Manufacture of basic pharmaceutical products and pharmaceutical preparations	61 - Telecommunications
23 - Manufacture of other non-metallic mineral products	62 - Computer programming, consultancy and related activities
24 - Manufacture of basic metals	63 - Information service activities
26 - Manufacture of computer, electronic and optical products	64 - Financial service activities, except insurance and pension funding
27 - Manufacture of electrical equipment	65 - Insurance, reinsurance and pension funding, except compulsory social security
29 - Manufacture of motor vehicles, trailers and semi-trailers	66 - Activities auxiliary to financial services and insurance activities
30 - Manufacture of other transport equipment	70 - Activities of head offices; management consultancy activities
31 - Manufacture of furniture	71 - Architectural and engineering activities; technical testing and analysis
32 - Other manufacturing	72 - Scientific research and development
33 - Repair and installation of machinery and equipment	73 - Advertising and market research
35 - Electricity, gas, steam and air conditioning supply	74 - Other professional, scientific and technical activities

Table 4 – List of knowledge intensive industries

Source - (Weterings, Van Oort, Raspe, & Verburg, 2007)

4.1.3. Survey data

A survey has been made and sent to examine and answer hypothesis 2 till 5 (appendix B). The survey investigates the effects of the assets (economic, physical and networking) on employment growth that has been described in the theoretical framework. In this framework, it has been noted that the three assets and their categories/factors are important for knowledge locations to become and stay economic stable and innovative (a 'successful' knowledge location), but it has never been examined before in other researches whether this is indeed the case. To analyse these three assets and their strength for knowledge locations, the survey has been sent to representatives of the 51 knowledge locations. The response rate is 75%; 38 of the 51 locations filled in the survey. Thirteen knowledge locations did not respond to the survey, which are 4 campuses, 3 innovation

hotspots and 6 science (business) parks. No pattern could be found in the 13 not responding knowledge locations, which makes the outcome not biased.

The survey starts with a list of all the knowledge locations and the opportunity to fill in the founding year.

Following these questions, the survey is build up in two parts. The first part treats the three assets overall. The participants are asked to fill in on a scale of 1 to 10 the degree to which they feel the different categories of the three assets (for example innovation cultivators, consumer amenities and local networking) are present at their knowledge location.

The data outcome of part one provides important information in answering to what degree the presence of the three assets on knowledge locations have their effect on employment growth of knowledge location based firms.

The second part contains questions about the different categories of the three assets and their factors. Participants are prompted to tick boxes with the factors that are summarized in the tables (appendix B) of the theoretical framework. These factors and their outcomes can be used to examine if some factors of the categories are more important than others. In this way, a table with the three assets, categories and factors can be made that have the biggest effect on employment growth of knowledge location based firms.

4.1.4. Variables

The dependent variable in the empirical analysis is the difference in jobs, which is the employment growth over the years and has been created by taking the percentage change of the variable jobs in the period 2003 – 2015 and is extracted from the LISA dataset. The variable jobs show how many fulltime jobs there are at a certain year, at a certain firm, and, location. The benefit of taking percentage changes instead of absolute numbers makes it easier to interpret the outcome and makes it clearer if firms on knowledge locations perform better than firms not localized here, regarding hypothesis 1. To deal with outliers in the model, the function winsorize has been used for the 1th and 99^{th} percentile. Winsorizing is not the same as excluding data, but it replaces extreme values with certain percentiles, in this case the 1^{st} and 99^{th} percentile.

The first independent variable of the empirical analysis is a dummy variable and discuss the firms who are located on knowledge locations. It shows whether a firm in the period of 2003

– 2015 is located on a knowledge location (value 1) or not (value 0). The independent variable has been created by merging the LISA dataset with the GIS map and has been controlled for the founding year of a knowledge location.

The next variables are independent variables and are used to analyse the outcomes of the survey. The first four variables are the economic assets variables, namely innovation drivers, higher education institutions, innovation cultivators and consumer amenities. These numeric variables contain a number between 1 (not present) and 10 (very abundant) to which degree the assets are present at a specific knowledge location. Due to the possibility of factor analysis, the first three economic assets are also combined into one variable, namely producer amenities and the fourth economic assets are consumer amenities. The physical assets have the same design as the economic assets, with four different variables, amenities & resources, place & building design, connectivity and image. The first three assets are also grouped together into the variable physical elements. With these variables, one new interaction variable has been created. This new variable is an interaction between consumer amenities and physical elements. The last category of assets, networking assets, consists of the variables local networking and global networking. A combination of these variables created the new variable networking. The dummy variables, which have been created from the survey outcomes, are not used since these variables do not show any significant results.

To control for factors that may influence the relationship between the employment growth (percentage change) in jobs and knowledge locations or assets of the knowledge location, multiple control variables are added to the empirical model. Starting with the control variable years. To make this variable better understandable, a categorization has been made in which three categories are defined, namely pre-crisis (2003 – 2007), crisis (2008 – 2011) and late-crisis (2012 – 2015). These three new variables are the control variables for three important periods in time. The importance of these variables is that the economic crisis, which started in 2008 and ended in 2011 had a major influence on the economy in the Netherlands and could influence the relationship between knowledge locations and employment growth (Lallement, 2011).

Other control variables are the size class variables, which are numbered from 1 to 6. These variables categorize the size (in number of the variable jobs) of firms. Starting with category one (size class 1) with 0 to 5 jobs, category 2 (size class 2) 5 – 10 jobs, category 3 (size class 3) 10 – 20 jobs, category 4 (size class 4) 20 – 50 jobs, category 5 (size class 5) 50 – 100 jobs

and category 6 (size class 6) >100 jobs. These size classes can demonstrate if the percentage changes in jobs can differ for different size classes of firms.

The next control variable is province code which are the province codes in The Netherlands. Some provinces in The Netherlands have more economic prosperity than other provinces and could thus influence the relationship between the dependent variable and independent variable.

The third variable is industry. This variable is the type of industry the firms are operating in, such as producing textile or the winning of minerals. It could be that certain industries have a higher employment growth than other industries, for example the types of firms on knowledge locations. If that would be the case, then it weakens the relationship between de dependent and independent variable if the model would not control for it.

The last control factor is male, which shows the percentage of the jobs that is performed by male. In this way, the model controls for the number of males that are working at firms in a certain year. Not adding these control variables to the empirical mode will increase the chance of omitted variable bias that will eventually make the empirical model weaker.

The control variables size classes and time periods have also another important addition to the model, namely creating interactions with the independent variable. The three time variables have been interacted with the independent variable. These new variables are the pre-crisis, crisis and late-crisis period, interacted with firms who are located on knowledge locations that can demonstrate if knowledge locations have different effects on the percentage changes in jobs in the different time periods.

The other interaction variables that have been created are the interactions between size classes and the independent variable. It could be that firms with different size classes on knowledge locations have different effects on the percentage changes in jobs. For example, small firms on geographically defined knowledge locations could grow faster than larger firms on knowledge locations.

Variable	Type	Description
Employment growth	Numeric variable	Percentage change of jobs – employment growth
Knowledge location	Dummy variable	Firm located on knowledge location (1) or not located on knowledge location (0)
Economic asset 1	Numeric variable	Knowledge location innovation drivers
Economic asset 2	Numeric variable	Knowledge location higher education institutions
Economic asset 3	Numeric variable	Knowledge location innovation cultivators
Economic asset 4	Numeric variable	Knowledge location consumer amenities
Producer Amenities	Numeric variable	Combination of economic assets 1 – 3
Consumer Amenities	Numeric variable	Knowledge location consumer amenities
Physical asset 1	Numeric variable	Knowledge location amenities & resources
Physical asset 2	Numeric variable	Knowledge location place & building design
Physical asset 3	Numeric variable	Knowledge location connectivity
Physical asset 4	Numeric variable	Knowledge location image
Physical elements	Numeric variable	Combination of physical assets 1 – 3
Image elements	Numeric variable	Knowledge location image
Networking asset 1	Numeric variable	Knowledge location local networking
Networking asset 2	Numeric variable	Knowledge location global networking
Networking	Numeric variable	Combination of local and global networking
Consumer amenities with physical elements	Numeric variable	Interaction variable between consumer amenities and physical elements
Pre-crisis	Numeric variable	Pre-crisis period (2003 – 2007)
crisis	Numeric variable	Crisis period (2008 – 2011)
Late-crisis	Numeric variable	Late-crisis period (2012 – 2015)
Size classes (1-6)	Numeric variable	Size classes of firms (6 classes)
Size classes on knowledge location	Numeric variable	Interaction variable between size classes and knowledge location dummy variable
Pre-crisis on knowledge location	Numeric variable	Interaction variable between pre-crisis period and knowledge location dummy variable
Crisis on knowledge location	Numeric variable	Interaction variable between crisis period and knowledge location dummy variable
Late-crisis on knowledge location	Numeric variable	Interaction variable between late-crisis period and knowledge location dummy variable
Industry	String variable	Control variable with 20 different industry types
Province code	Numeric variable	Control variable with 12 province codes
Male	Numeric variable	Control variable for male, percentage of jobs

Table 5 - List of variables

4.2. Research method & empirical model

To examine and analyse the effect of geographically defined knowledge locations on employment growth (hypothesis 1), the correct type model must be chosen. Since the data consists of a panel dataset, because there are observations (jobs) over time (2003 – 2015) for individuals (firms), the choices for an appropriate model have been reduced. One of the possibilities is a fixed effects model or a random effects model. To make a choice between those two models, a Hausman test has been conducted. In the null-hypothesis of the Hausman test it is stated that a random effects model is more efficient. If the null-hypothesis is rejected, the alternative fixed effects model is at least as consistent as the random effects model and is therefore preferred. The test results (appendix figure A1) show that the null-hypothesis can be rejected and thus makes the fixed effects model more suitable for the empirical analysis. An important argument for choosing the fixed effects model is that this model controls for time invariant factors, factors that do not change overtime, such as industry type, provinces, firm specific factors and many other factors. But there is also a problem with the fixed effects model. Regarding the first hypothesis, whether a firm on a geographically defined knowledge location has a higher employment growth than a firm not localized here. The knowledge location variable is a dummy variable, 0 or 1. In this case there are time periods that a firm does not move from or to a knowledge location, the value stays 0 or 1. The fixed effects model sees this as a time invariant factor and thus controls it as a control factor and not as an independent variable.

But since it is not possible to control for many time invariant factors and thus possibly dealing with the omitted variable bias, the fixed effects model is the appropriate model. In the empirical analysis, an alternative model, pooled ordinary least square (OLS) model, is added to check how the outcomes relates to the fixed effects model. The time invariant control factors are added in this model to deal with the omitted variable bias.

The empirical main model that is used is the following.

$$\Delta E = f(F, KL, L, I, T)$$

This formula briefly explains the design of the empirical analysis. E stands for employment, which is the percentage changes in jobs (employment growth), regarding this formula. The F

stands for firms and controls all factors that influence firms, such as size class and male. KL is the abbreviation of knowledge location and includes the firms who are located on knowledge locations. L is the location, which should deal with the effects of the surrounding, like provinces. I is the industry factor that controls for different types of industry. The last one is time, which shows the effect of different time periods on employment growth.

To analyse the effects of the outcomes of the survey a fixed effects model won't be suitable since the survey outcomes do not change overtime. A possible model would be a multilevel model that combines the strengths of the fixed effects model and random effect models. In a multilevel model, a hypothesis will show if these models are more suitable than linear models. When this is the case, then a linear model controlling for a cluster effect is being analysed. Since the data of the survey outcomes only provide results for 38 of the 51 outcomes it's possible that the models should deal with problems regarding the significance level. If this problem arises, another opportunity in analysing the results is examined, namely factor analysis. Factor analysis is a method of analysing the variance of observed, correlated variables. Collapsing these observed correlated variables together into a few factors provides the opportunity to analyse concepts which are normally not clearly visible. An important node in the analysis of hypothesis 2 till 5 is that the firms who are not positioned on knowledge locations have been deleted from the dataset, since the hypotheses stated that the focus is purely on knowledge locations.

In every empirical analysis of all hypotheses an extra control analysis is conducted that focuses on knowledge intensive firms, which is shown in the *SBI code* paragraph. The reason behind this extra analysis, is the conceptual framework, which states that a knowledge location is based on a knowledge based economy and carried out by knowledge intensive firms, which in the dataset are called narrow sense firms.

5. Results & robustness

5.1. Results hypothesis 1

In this part of the research, the results of the empirical analysis are presented and discussed. The first hypothesis is: *firms on geographically defined knowledge locations have stronger employment growth compared to firms at other locations.*

The table below contains four fixed effects models and one pooled OLS model with several interaction variables to answer the hypothesis. The first model shows an overall main outcome of the effect of knowledge locations on employment growth of firms located on geographically defined knowledge locations. The next models (2,3,4) have added interaction variables to present an in-depth analysis. The last model, a pooled OLS model, is an alternative model for the fixed effects model and is used as a check for the other models and their outcomes.

	(M1) - FE	(M2) – FE preferred model	(M3) - FE	(M4) - FE	(M5) – Pooled OLS
Variables	Employment growth	Employment growth	Employment growth	Employment growth	Employment growth
Firms located on knowledge location	-0.014***	0.033***	0.003	0.051***	0.010**
	(0.003)	(0.007)	(0.003)	(0.008)	(0.005)
Crisis (2008 – 2011)	-0.017***	-0.017***	-0.017***	-0.017***	-0.006***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Late-crisis (2012 – 2015)	-0.030***	-0.030***	-0.030***	-0.030***	-0.012***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Located on knowledge location during crisis		-0.035***		-0.035***	-0.006
		(0.007)		(0.007)	(0.006)
Located on knowledge location during late-crisis		-0.055***		-0.056***	-0.006
		(0.007)		(0.007)	(0.005)
Size class 2 (5 – 10 jobs)	0.238***	0.238***	0.238***	0.238***	0.061***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Size class 3 (10 – 20 jobs)	0.390***	0.390***	0.390***	0.390***	0.060***

Table 6 continued	(M1) - FE	(M2) – FE preferred model	(M3) - FE	(M4) - FE	(M5) – Pooled OLS
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Size class 4 (20 – 50 jobs)	0.512***	0.512***	0.513***	0.513***	0.051***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.000)
Size class 5 (50 – 100 jobs)	0.624***	0.625***	0.625***	0.625***	0.042***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Size class 6 (> 100 jobs)	0.729***	0.729***	0.729***	0.729***	0.040***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)
Firms in size class 2 located on knowledge location			-0.025***	-0.029***	0.024***
			(0.009)	(0.009)	(0.006)
Firms in size class 3 located on knowledge location			-0.052***	-0.054***	0.029***
			(0.011)	(0.011)	(0.007)
Firms in size class 4 located on knowledge location			-0.080***	-0.080***	0.006
			(0.011)	(0.011)	(0.006)
Firms in size class 5 located on knowledge location			-0.083***	-0.084***	-0.009
			(0.016)	(0.015)	(0.008)
Firms in size class 6 located on knowledge location			-0.018	-0.017	0.002
			(0.013)	(0.013)	(0.006)
Mining and quarrying					-0.026***
					(0.004)
Manufacturing					-0.022***
					(0.001)
D Electricity, gas, steam and air conditioning supply					-0.008**
					(0.004)

Table 6 continued	(M1) - FE	(M2) – FE preferred model	(M3) - FE	(M4) - FE	(M5) – Pooled OLS
Water supply; sewerage, waste management and remediation activities					-0.016***
					(0.002)
Construction					-0.013***
					(0.000)
Wholesale and retail trade; repair of motor vehicles and motorcycles					-0.017***
					(0.000)
Transportation and storage					-0.010***
					(0.001)
Accommodation and food service activities					-0.011***
					(0.001)
Information and communication					-0.007***
					(0.001)
Financial institutions					-0.025***
					(0.001)
Renting, buying and selling of real estate					-0.014***
					(0.001)
Consultancy, research and other specialized business services					-0.011***
					(0.000)
Renting and leasing of tangible goods and other business support services					-0.007***
					(0.001)

Public administration, public services and compulsory social security					-0.040***
					(0.001)
Education					-0.029***
					(0.001)
Human health and social work activities					-0.012***
					(0.001)
Culture, sports and recreation					-0.018***
					(0.000)
Other service activities					-0.020***
					(0.001)
Extraterritorial organisations and bodies					-0.017***
					(0.005)
Province of Friesland					-0.012***
					(0.000)
Province of Drenthe					-0.005***
					(0.001)
Province of Overijssel					0.001
					(0.000)
Province of Flevoland					0.002***
					(0.001)
Province of Gelderland					0.006***
					(0.000)
Province of Utrecht					-0.006***
					(0.000)
Province of Noord-Holland					-0.007***
					(0.000)
Province of Zuid-Holland					-0.007***
					(0.000)
Province of Zeeland					-0.007***

					(0.001)
Province of Noord-Brabant					-0.007***
					(0.000)
Province of Limburg					-0.010***
					(0.000)
Percentage of jobs executed by male	-0.098***	-0.098***	-0.098***	-0.098***	-0.009***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Constant	0.022***	0.022***	0.022***	0.022***	0.041***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	11,782,405	11,782,405	11,782,405	11,782,405	11,782,405
R-squared	0.054	0.054	0.054	0.054	0.014
Number of lisacode	1,994,702	1,994,702	1,994,702	1,994,702	

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6 – Regression models narrow sense firms

5.1.1.1. Growth dynamics

Knowledge location effect

The main outcomes of table 6 indicates that locating on a knowledge location decreases the employment growth with 1.4% at 1% significance level in the period 2003 – 2015 c.p. A reason could be that the economic crisis had a major effect on knowledge locations in the period 2003 – 2015, since the period 2008 – 2015 had to deal with the downturn effects of the crisis and the recovery. This large part of the period suggests that adding control variables for time periods, such as pre-crisis, crisis and late-crisis, is a smart choice in order to control for the time effects. The addition of these control variables offers the opportunity to strengthen the model and provide a more detailed explanation of the knowledge location effect.

Resilience of the crisis

When focusing more in detail on knowledge locations with the addition of the above described time periods, the results suggest that firms located on a knowledge location

during pre-crisis face an additional growth in employment of 5.5% compared to firms at other locations that had an increase of 2.2% at the 1% significance level c.p. The next two periods, crisis and late-crisis show results that are worse than firms at other locations. During the crisis, knowledge location based firms had an additional increase in employment growth of 0.3% against 0.5% of other located firms (1% significance level) c.p. In the late-crisis period, the additional employment growth on knowledge locations decreased with 3% compared to -0.8% at other locations at the 1% significance level, c.p. These outcomes indicate that over time the results are not robust. This is not unlikely, since the economic crisis (2008 – 2011) was one with extreme effects and that could strongly influence the effect of knowledge locations on employment growth in a negative way. Firms located on a knowledge location could be highly interwoven with each other, because of the cluster effect of knowledge locations. Knowledge locations focus on specific clusters/industries which make firms more sensitive for externalities. This means that if there is an economic downturn (economic crisis) the firms may become easily vulnerable for negative economic effects and thus a decrease in employment growth.

Economies of scale in firms and clusters

The models also control for firm size and the results suggest that larger firms grow faster than smaller firms. These results are robust throughout the different models. This is not surprising, since larger firms offer more scale economies than smaller firms.

The outcomes of firms with different size classes located on a knowledge location indicate that the economies of scale are smaller than for firms not located on a knowledge location. Firms in the size class 2 – 5 have a small additional decrease in employment growth if they are located on a knowledge location. The possible reason for these outcomes could be that the cross-linked relationships with other firms ensure that the scale effect does not take place on the firm level, but on the cluster level.

Combining the interaction variables of time periods and size classes in one model, the outcomes suggest that knowledge location based firms in size class 1 during the pre-crisis, have an additional increase in employment growth of 7.3% (1% significance level), c.p. Since the other outcomes of different size classes and time periods are hard to interpret, the figure below (figure 4) provides a good understanding. As the firm size becomes bigger for knowledge location based firms, the employment growth will decrease, but increases at the

end again. The confidence intervals show that the precise additional increase/decrease of employment growth can fluctuate between the bandwidth. The figure suggests that small and large firms profit from knowledge locations and a reason for this can be that small firms easily benefit from the cluster effects of knowledge locations while the large firms are possibly less vulnerable for economic shock effects, such as the economic crisis.

An important notion is that the R-squared of all the models is very low, which means that a large part of the variance could not be explained by the models. This is also the reason why model 5 could not be the main model, because in this model the R-squared is even lower. This indicates that there are time-invariant factors that are not explained in the model, but included in the fixed effects models.

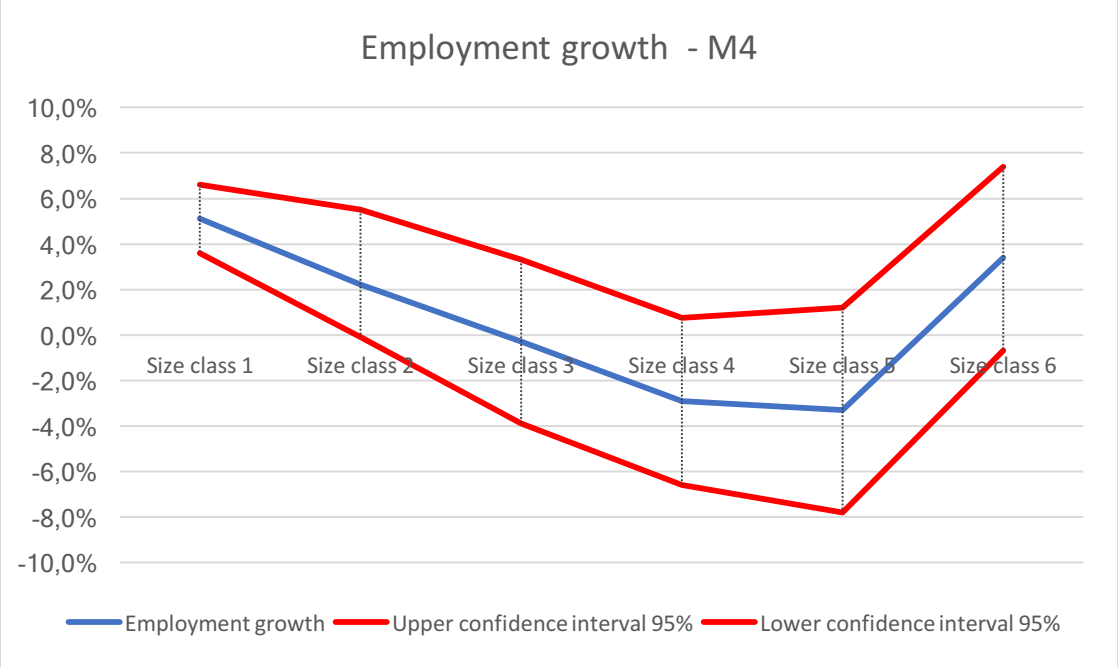


Figure 4 – Employment growth for different size classes (narrow sense)

Knowledge intensive firms

As mentioned in the theoretical framework and data description, a knowledge location is based on a knowledge-based economy with knowledge intensive firms (creative and innovative entities). To analyse the effect of knowledge locations on employment growth with only knowledge intensive firms (narrow sense), the dataset has been reduced regarding the list of SBI codes in table 4. The specific reason for this in-depth analysis of knowledge intensive firms is the conceptual framework (figure 1). The fundament of knowledge locations is the knowledge-based economy in which knowledge is a very important part and

is expressed by knowledge intensive firms. For this reason, it's interesting to see whether the outcomes of the narrow sense data analysis can support the conceptual framework in figure 1.

	(M5) - FE	(M6) – FE	(M7) - FE	(M8) - FE	(M9) – Pooled OLS
Variables	Employment growth	Employment growth	Employment growth	Employment growth	Employment growth
Firms located on a knowledge location	-0.014***	0.063***	0.003	0.079***	0.017**
	(0.005)	(0.011)	(0.005)	(0.011)	(0.007)
Crisis (2008 – 2011)	-0.019***	-0.019***	-0.019***	-0.019***	-0.009***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Late-crisis (2012 – 2015)	-0.031***	-0.031***	-0.031***	-0.031***	-0.014***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Located on knowledge location during crisis		-0.054***		-0.052***	-0.005
		(0.010)		(0.010)	(0.009)
Located on knowledge location during late- crisis		-0.093***		-0.092***	-0.012
		(0.011)		(0.011)	(0.008)
Size class 2 (5 – 10 jobs)	0.227***	0.227***	0.227***	0.227***	0.077***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Size class 3 (10 – 20 jobs)	0.353***	0.354***	0.354***	0.355***	0.074***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)
Size class 4 (20 – 50 jobs)	0.453***	0.453***	0.454***	0.455***	0.059***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.001)
Size class 5 (50 – 100 jobs)	0.544***	0.545***	0.545***	0.546***	0.045***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.002)
Size class 6 (> 100 jobs)	0.642***	0.643***	0.643***	0.644***	0.037***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.001)
Firms in size class 2 located on knowledge location			-0.021	-0.025**	0.022**
			(0.013)	(0.013)	(0.009)
Firms in size class 3 located on knowledge location			-0.065***	-0.065***	0.021**
			(0.017)	(0.017)	(0.009)
Firms in size class 4 located on knowledge location			-0.077***	-0.073***	0.005
			(0.018)	(0.018)	(0.008)
Firms in size class 5 located on knowledge location			-0.086***	-0.080***	0.011
			(0.024)	(0.023)	(0.013)
Firms in size class 6 located on knowledge location			-0.058***	-0.050***	-0.021**
			(0.019)	(0.019)	(0.009)
Constant	0.077***	0.077***	0.077***	0.076***	0.023***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	2,524,926	2,524,926	2,524,926	2,524,926	2,524,926
R-squared	0.045	0.045	0.045	0.045	0.017
Number of lisacode	479,664	479,664	479,664	479,664	

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7 – Regression models narrow sense firms

Controlled for industry, provinces and male – appendix B.1

Knowledge location effect

The table above (table 7) shows that firms at knowledge locations again underperform compared to firms at other locations. The narrow sense firms face a similar decrease compared to the broad sense firms, which could indicate that the cluster effect of knowledge locations is not strong. Adding the time control variables, to control for the economic crisis, will provide interesting results for the narrow sense firms.

Resilience to the crisis

The results with the addition of time control variables suggest that knowledge location based firms, during all time periods, have an additional increase in employment growth of 14% and 6.7% and 1.6% (1% significance level), c.p. These outcomes are interesting compared to the firms at other locations, where the pre-crisis indicates an increase of 7.7%, crisis 5.8% and 4.6% during late-crisis (1% significance level) c.p. When comparing these outcomes with the broad sense firms, it shows that during pre-crisis and crisis knowledge location based firms are better off in contrast to other located firms. It's possible that knowledge intensive firms, which are heavily cross-linked within the knowledge location, build a strong and vital economic network since knowledge intensive industries are less vulnerable to economic shock effects.

Economies of scale in firms and clusters

Knowledge intensive firms with different size classes face also the effect that larger firms have a larger employment growth than smaller firms, indicating that economies of scale are probably responsible for this effect. The outcomes for knowledge intensive firms located on knowledge locations with different size classes are similar to the results in the broad sense. As the size class increases, the additional negative effect on employment growth increases and decreases again in size class 6. Knowledge intensive firms should also possibly deal with strong inter-relationships on knowledge locations which eventually causes the economies of scale effect on cluster level instead on firm level. The combination of economies of scale and various time periods show in the figure below that knowledge intensive firms have a more positive outcome on employment growth than firms in the broad sense. Knowledge intensive firms could benefit more from knowledge locations and their cluster effect since

the knowledge locations attract specific industries and thus have easier profit from each other with the addition of cross-linked relationships between the knowledge intensive firms.

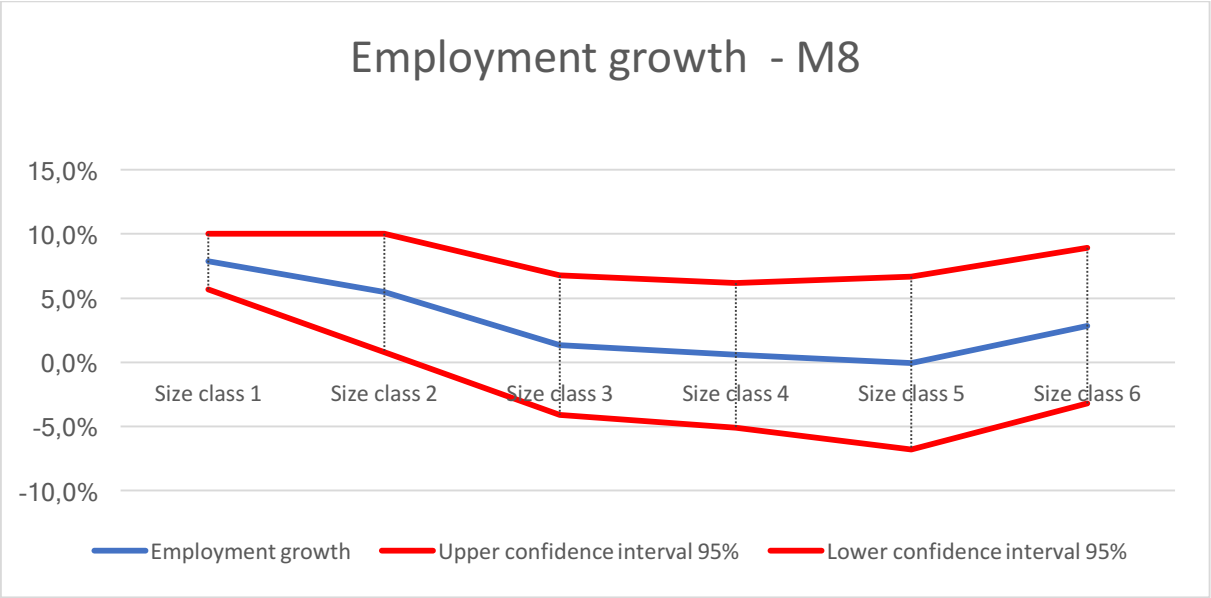


Figure 5 – Employment growth for different size classes (narrow sense)

To give a clear overview, the next figure provides a good understanding of the knowledge location effect with broad and narrow sense firms compared to firms at other locations during different time periods. Keep in mind that the overall outcome on employment growth for broad and narrow sense firms at knowledge locations is worse than for firms at other locations.

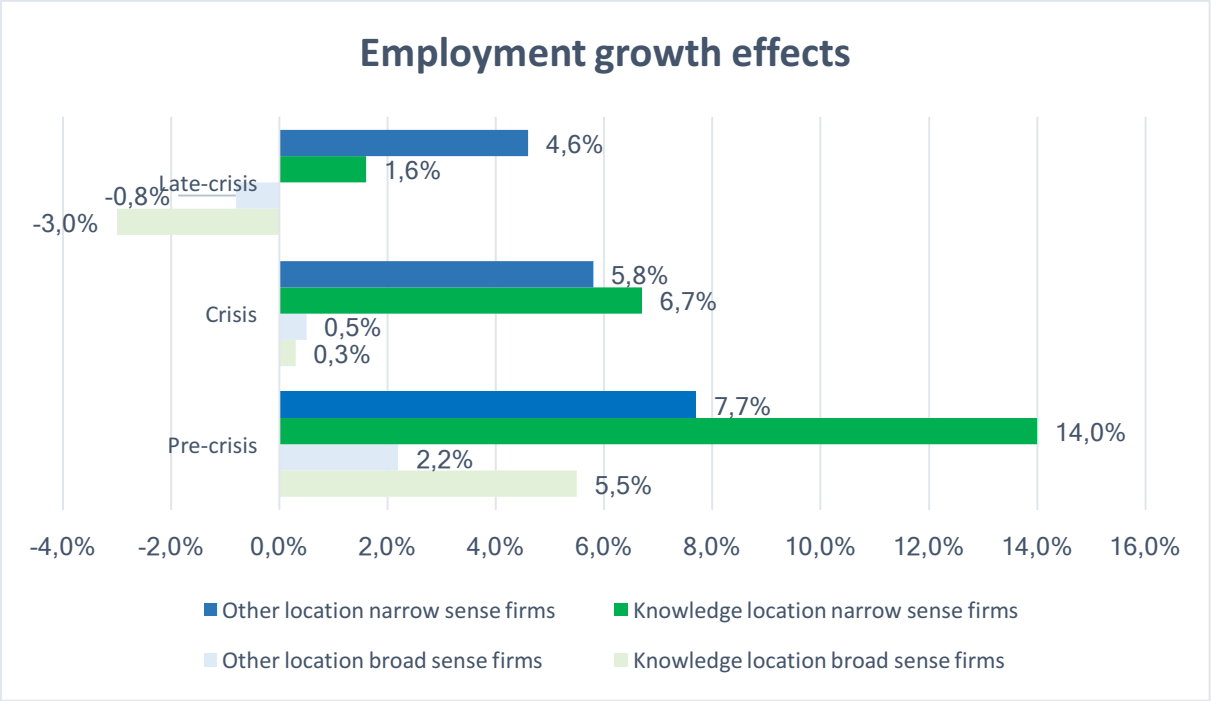


Figure 6 – Bar chart with employment growth for knowledge locations and other locations

Knowledge location buffer

The results from the previous models are evaluated on robustness by creating several buffer radii around knowledge locations. The importance of the robustness checks is to analyse whether the knowledge locations have spillover effects, which means that firms in the surrounding of knowledge locations can profit from the externalities of the knowledge locations. There are two buffer radii created, namely 1000 meter and 2000 meter. In the table below (table 8) the results are tabulated with both broad and narrow (knowledge intensive firms) sense firms. The assumption in the previous paragraph is that knowledge locations have a strong growth dynamic and that overall knowledge location based firms underperform compared to firms at other locations. These effects hold for both buffer radii in broad and narrow sense, but will decrease as the radius increases. This would be logical since the externalities of the knowledge location will decrease as the radius becomes larger. These externalities are stronger for knowledge intensive firms in different buffer radii than for the broad sense firms. This suggested effect could be originated by cluster effects. Knowledge intensive firms benefit more from cluster effects and inter-relationships of knowledge locations than broad sense firms. The sensitivity analysis provides a reasonable robustness of the effect of knowledge locations on employment growth for different buffers

	M2a	M2b	M2c	M6a	M6b	M6c
Firms specification	Broad	Broad	Broad	Narrow	Narrow	Narrow
Buffers	Reference	1000m	2000m	Reference	1000m	2000m
Variables	Employment growth	Employment growth	Employment growth	Employment growth	Employment growth	Employment growth
Firms located on a knowledge location	0.033***	0.021***	0.003	0.063***	0.046***	0.022***
	(0.007)	(0.006)	(0.002)	(0.011)	(0.010)	(0.005)
Crisis (2008 – 2011)	-0.017***	-0.017***	-0.017***	-0.019***	-0.019***	-0.019***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Late-crisis (2012 – 2015)	-0.030***	-0.030***	-0.030***	-0.031***	-0.031***	-0.031***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Located on knowledge location during crisis	-0.035***	-0.017***	-0.004*	-0.054***	-0.037***	-0.019***
	(0.007)	(0.006)	(0.002)	(0.010)	(0.010)	(0.004)
Located on knowledge location during late- crisis	-0.055***	-0.033***	-0.009***	-0.093***	-0.063***	-0.031***
	(0.007)	(0.006)	(0.002)	(0.011)	(0.010)	(0.005)
Constant	0.022***	0.022***	0.022***	0.077***	0.077***	0.077***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	11,782,405	11,782,853	11,782,852	2,524,926	2,524,938	2,524,936
R-squared	0.054	0.054	0.054	0.045	0.045	0.045
Number of lisacode	1,994,702	1,994,711	1,994,711	479,664	479,665	479,665

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 8 – Robustness analysis with different buffer radii

Controlled for size classes and male – appendix B.2

Hypothesis 1

To answer the first hypothesis which is defined as; *firms on geographically defined knowledge locations have stronger employment growth compared to firms at other locations,* the focus is on three aspects, namely the knowledge location effect, resilience to the crisis and economies of scale. Frome these aspects, it can be concluded that hypothesis 1 is not supported. Firms on geographically defined knowledge locations do not have a stronger employment growth compared to firms at other locations. Adding time periods suggest that the knowledge locations face a specific growth dynamic with a positive outcome during pre-crisis and crisis and, a negative outcome in late-crisis period for broad

sense firms. But the results for firms at other locations show better outcomes, especially during the crisis and late-crisis period. For narrow sense firms, the results are somewhat better compared to other located firms; within every period a positive outcome on employment growth and only during late-crisis period a stronger employment growth for other located firms.

Knowledge location based firms with different size classes indicate that small and large firms benefit from knowledge locations, but the middle size classes have to deal with additional decreases in employment growth.

Narrowing the firm type to only knowledge intensive firms suggests that knowledge intensive firms overall face a similar negative outcome, but with a more positive outcome during different time periods. The effect of knowledge intensive firms on knowledge locations with different size classes show a more positive effect on employment growth than firms in the broad sense.

The positive effect on employment growth during various time periods holds for the two buffer radii (spillover effect). As the buffer becomes larger the positive effect of knowledge locations on employment growth will decrease caused by a relative decrease in (positive) externalities. The spillover effects are stronger for knowledge intensive firms than firms in the broad sense.

The growth dynamics indicate that time is a major influencer on the effect of knowledge locations on employment growth. This same effect occurs at knowledge intensive firms. The reason for this specific growth dynamic could be the unique time period. The global financial crisis (2008 – 2011) was one with an extreme downwards spiral and is considered as the worst crisis since the Great Depression in the 1980's (Eigner & Umlauft, 2015). This unique time period makes it interesting to propose a new hypothesis that can be examined in the future; *firms on geographically defined knowledge locations have stronger growth dynamics compared to firms at other locations.*

5.2. Results hypothesis 2

To analyse hypothesis 2, which is defined as; *knowledge locations with stronger economic assets foster stronger employment growth of firms on geographically defined knowledge locations*, an appropriate model should be found. Starting with multilevel modelling, the outcomes show that only 3,5% of the variance of employment growth can be explained by knowledge locations and that a linear model is more suitable than a multilevel model (hypothesis rejected) (appendix figure A.2).

Following these results, a linear regression model has been analysed to investigate if this model is more appropriate in analysing the outcomes of the survey. The linear regression model shows that only the economic assets, which focus on innovation drivers, are significant (appendix figure A.3). Since these narrow outcomes are not favourable, bundling the economic assets together (factor analysis) may give better and more interpretable results. To apply a factor analysis, a resume of the economic assets should be given. The first economic asset is innovation drivers, such as creative firms, high-technology firms, software firms, highly specialized firms, the presence of a leading firm, park management. The second asset is the higher education institutions, which can be described as having strong ties with higher education institutions, research driven, access to students for jobs, a higher education institution-government-industry link (triple helix concept). The third category is innovation cultivators, such as incubators, venture capitalists and institutions that stimulate growth & innovation. The last one is consumer amenities, such as restaurants, coffee places, bars (cafés), hotels, retail shops, good public services.

The factor analysis indicates that the economic assets for innovation drivers, higher education institutions and innovation cultivators, have many similarities (producer amenities) and that consumer amenities have a more unique character (appendix figure A.4). With this information provided, two variables are created that separate these economic assets into two groups, specifically producer amenities and consumer amenities.

	M10	M11
Firm specification	Broad	Narrow
Variables	Employment growth	Employment growth
Knowledge location producer amenities	0.003	0.008*
	(0.003)	(0.005)
Knowledge location consumer amenities	0.015**	0.018**
	(0.007)	(0.008)
Located on knowledge location during crisis (2008 – 2011)	-0.024**	-0.050**
	(0.010)	(0.023)
Located on knowledge location during late-crisis (2011 – 2015)	-0.024**	-0.066***
	(0.010)	(0.023)
Constant	0.060***	0.176***
	(0.022)	(0.036)
Observations	17,703	7,867
R-squared	0.024	0.031

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 9 – Regression models broad & narrow sense firms

Controlled for size classes, industries, provinces and male – appendix B.3

Producer amenities

The outcomes of the table above, with broad sense firms, indicate that producer amenities on knowledge locations, such as innovation drivers, higher education institutions and innovation cultivators are not influencing employment growth. This suggests that stronger producer amenities do not foster any strength to daily business activities and thus employment growth of broad sense firms on knowledge locations. A reason could be that broad sense firms use less of the strength of knowledge locations, such as links to higher education institutions or clustering effects.

The results for knowledge intensive firms suggest that when the survey score increases with 1 point on a 1 to 10-point scale, the employment growth increases with 0.8% at the 5% significance level, c.p. The range of the producer amenities in the survey score is 5.15, which indicates that the difference in employment growth between the best and worst location on producer amenities is 4.12%. These outcomes are important and interesting, since it could

be that knowledge intensive firms are more willing to use the benefits of the strengths of knowledge locations with higher producer amenities.

Consumer amenities

The results show that broad sense firms on knowledge locations benefit from consumer amenities with an increase in employment growth of 1.5% if the survey score increases with 1 point at the 5% significance level, c.p. The range of the survey score is 8 points and shows that the employment growth between the worst and best location with consumer amenities can have a difference of 12%. Consumer amenities, such as restaurants, coffee places, bars (cafés), hotels, retail shops, good public services, provide strength to broad sense firms on knowledge locations. This is not unlikely, since consumer amenities could foster local networking (stimulating local buzz) or increase the level of working conditions. These elements may contribute to the exchange of knowledge and information or make employees of knowledge location based firms more happy and may also provide a better working experience which eventually leads to more stable and economically vital firms and thus an increase in employment growth.

The outcomes for knowledge intensive firms are even stronger; stronger consumer amenities provide 1.8% increase in employment growth with an increase of 1 point on the survey score for knowledge intensive firms on knowledge locations and thus a range of 14.4% on employment growth. The importance of consumer amenities on knowledge locations for knowledge intensive firms increases. The effect of consumer amenities on local networking and working conditions could be more important and beneficial for knowledge intensive firms and their employees.

Economic assets buffer

The outcomes that are provided above are evaluated on robustness by creating buffer radii of 1000 and 2000 meter. The use of factor analysis was not suitable since the uniqueness of the four economic assets decreased. This does not make it possible to categorize the four economic assets into the two types of amenities, namely producer and consumer amenities and to compare it with the results above. Knowing this, a normal regression with the four separate economic assets is created and provides better understanding in the robustness of the effect of economic assets on employment growth at knowledge locations.

	M10a	M11a	M10b	M11b
Firm specification	Broad	Narrow	Broad	Narrow
Buffers	1000m	2000m	1000m	2000m
Variables	Employment growth	Employment growth	Employment growth	Employment growth
Knowledge location with innovation drivers (economic asset 1)	-0.010**	-0.014***	-0.004***	-0.006***
	(0.004)	(0.005)	(0.001)	(0.002)
Knowledge location with higher education institutions (economic asset 2)	0.005**	0.010***	0.003**	0.001
	(0.002)	(0.003)	(0.001)	(0.002)
Knowledge location with innovation cultivators (economic asset 3)	0.004	0.001	-0.001	0.001
	(0.004)	(0.003)	(0.001)	(0.002)
Knowledge location with consumer amenities (economic asset 4)	-0.008***	-0.008**	-0.002**	-0.002
	(0.003)	(0.004)	(0.001)	(0.002)
Located on knowledge location during crisis (2008 – 2011)	-0.008	-0.017	-0.006*	-0.016**
	(0.009)	(0.014)	(0.003)	(0.006)
Located on knowledge location during late-crisis (2011 – 2015)	-0.019**	-0.029*	-0.011***	-0.021***
	(0.007)	(0.015)	(0.003)	(0.007)
Constant	0.082***	-0.013	0.051**	0.035**
	(0.023)	(0.039)	(0.020)	(0.015)
Observations	13,053	5,151	63,022	19,672
R-squared	0.028	0.045	0.019	0.034

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 10 – Robustness analysis with different buffer radii

Controlled for size classes, industries, provinces and male – appendix B.4

The producer amenities, which consist of innovation drivers, higher education institutions and innovation cultivators contradict the outcomes of the main model. Only higher education institutions suggest contribution to employment growth for broad and narrow sense firms. An example of this positive externality could be that students graduated from higher education institutions find more easily jobs in and in the surrounding of knowledge locations.

The results for innovation drivers are even negative and for innovation cultivators not significant. This could indicate that innovation drivers do not provide any spillover effect (cluster effect) in the surrounding of the knowledge location since innovation cultivators may be primarily focused on firms on knowledge locations.

The last economic asset, which is consumer amenities, indicates for all buffer radii and for all types of firms (broad and narrow) a negative effect on employment growth, which is again not robust. It could be that firms and their employees in the surroundings of knowledge locations do not use the consumer amenities and thus do not benefit here from the possible local networking and local buzz. The other possible reason is that employees of firms in the surrounding do not take advantage of consumer amenities and subsequently not improve their working conditions. The main conclusion of this sensitivity analysis is that the robustness of the economic assets does not hold.

hypothesis 2

The findings above are inconclusive to answer hypothesis 2. *Knowledge locations with stronger economic assets foster stronger employment growth for firms*. No clear evidence has been found that the economic assets foster stronger employment growth at knowledge locations. The evidence that has been found is sometimes unclear or contradictory.

The producer and consumer amenities are contributing to employment growth on knowledge locations. Especially consumer amenities are important for the increase in employment growth and this could be due to the stimulus of local networking and/or local buzz or the improvement of working conditions. However, the sensitivity analysis indicates that these outcomes are not robust and sometimes contradictory in a broader area, with negative and significant (5% and 1%) effects on innovation drivers or no effect on innovation cultivators. The higher education institutions do provide strength to employment growth for broad and narrow sense firms, but not in every buffer. The last asset, consumer amenities is

again contradictory with negative coefficients for every buffer and firm type. The overall conclusion suggests an inconclusive answer to hypothesis 2.

5.3. Results hypothesis 3

To analyse hypothesis 3, which is defined as; *knowledge locations with stronger physical assets foster stronger employment growth of firms on geographically defined knowledge locations*, an appropriate model to analyse the survey outcomes should be found. Starting with multilevel modelling, the outcomes show that only 2,8% of the variance of employment growth can be explained by knowledge locations and that a linear model is more suitable than a multilevel model (hypothesis rejected) (appendix figure A.5).

Following these results, a linear regression model has been analysed to investigate if this model is more appropriate in analysing the outcomes of the survey. The linear regression model shows that none of the physical assets are significant (appendix figure A.6). Since these outcomes are not favourable, bundling these physical assets together in a factor analysis may give a better interpretable outcome. To apply a factor analysis, a resume of the economic assets should be given. There are four physical assets. The first one is amenities & resources, such as public spaces like parks, plazas and streets, digital accessible (Wi-Fi) and open spaces with the creation of social interaction. The second category is place & building design, which is the level of openness of the knowledge location and the quality of the design. The next asset is connectivity, including the connecting elements, like public transport system, bike paths, sidewalks and public open spaces on knowledge locations. The last asset is image, which is the attractiveness and reputation of the knowledge location.

The factor analysis indicates that the physical assets for amenities & resources, place & building design and connectivity are highly correlated together and that the image element of the physical assets has a more unique character (appendix figure A.7). To analyse these results in a regression analysis, two new variables have been created by merging the variables together in a specific order, namely physical elements and image elements. Physical elements are the amenities & resources, place & building design and connectivity. The image element is the variable that covers the image and reputation of a knowledge location.

	M12	M13
Firm specification	Broad	Narrow
Variables	Employment growth	Employment growth
Knowledge location with physical element	0.010***	0.0011 **
	(0.004)	(0.005)
Knowledge location with image elements	-0.009	-0.015
	(0.007)	(0.009)
Located on knowledge location during crisis (2008 – 2011)	-0.025**	-0.044**
	(0.010)	(0.021)
Located on knowledge location during late-crisis (2011 – 2015)	-0.026***	-0.062***
	(0.008)	(0.018)
Constant	0.049**	0.148***
	(0.021)	(0.031)
Observations	17,703	8,152
R-squared	0.024	0.031

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 11 – Regression models broad & narrow sense firms

Controlled for size classes, industries, provinces and male – appendix B.5

Physical elements

The outcomes in the table above suggest that the physical elements, which cover amenities & resources, place & building design and connectivity, have an increase in employment growth of 1% if the survey score increases with 1 point for broad sense firms positioned at knowledge locations at the 1% significance level c.p. This outcome is not unlikely, since these elements foster an increase in quality of the work environment. Public spaces where people from various firms can meet and interact. An open environment and good connectivity invites people to the knowledge location and improves working conditions.

The results of physical elements for knowledge intensive firms decrease to 0.11% in employment growth at the 5% significance level c.p. It seems a little bit unlikely, but could be explained by the fact that some factors of the physical elements are less important for knowledge intensive firms, for example place & building design. This could be the answer for a decrease in employment growth compared to firms in the broad sense.

Image elements

The image elements outcomes show that these coefficients are not significant for broad and narrow sense firms, which is contradictory with previous researches. The reputation and attractiveness of a knowledge location is may be less important than expected. Nowadays, knowledge locations are becoming a more regular asset in the environment and do not create an 'exciting' effect anymore when people walk by or talk about it.

Physical assets buffer

The outcomes that are provided in the table above are evaluated on robustness by creating buffer radii of 1000 and 2000 meter. The use of factor analysis was not suitable since the uniqueness of the four physical assets decreased. This makes it not possible to categorize the four physical assets into the two types of elements, physical and image elements, and compare it with the results above. Knowing this, a normal regression with the four separate physical assets is created and that provides better understanding in the robustness of the effect of physical assets on employment growth at knowledge locations.

	M12a	M13a	M12b	M13b
Firm specification	Broad	Narrow	Broad	Narrow
Buffers	1000m	2000m	1000m	2000m
Variables	Employment growth	Employment growth	Employment growth	Employment growth
Knowledge location with amenities & resources (physical asset 1)	0.009*	0.009*	0.004**	0.006**
	(0.005)	(0.005)	(0.001)	(0.003)
Knowledge location with place & building design (physical asset 2)	-0.007	-0.002	-0.003	-0.002
	(0.005)	(0.005)	(0.002)	(0.002)
Knowledge location with connectivity (physical asset 3)	0.001	-0.003	-0.001	-0.003
	(0.004)	(0.003)	(0.001)	(0.002)
Knowledge location with image (physical asset 4)	-0.008***	-0.014***	-0.003***	-0.006***
	(0.002)	(0.002)	(0.001)	(0.001)
Located on knowledge location during crisis (2008 – 2011)	-0.008	-0.020	-0.005	-0.016**
	(0.010)	(0.014)	(0.003)	(0.006)
Located on knowledge location during late-crisis (2011 – 2015)	-0.019**	-0.031*	-0.010***	-0.020***
	(0.007)	(0.015)	(0.002)	(0.006)
Constant	0.128***	0.056	0.065***	0.065***
	(0.028)	(0.039)	(0.018)	(0.018)
Observations	13,053	5,185	63,022	19,672
R-squared	0.028	0.045	0.019	0.034

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 12 – Robustness analysis with different buffer radii

Controlled for size classes, industries, provinces and male – appendix B.6

The results above indicate that the first physical assets, amenities & resources, have a significant (10%) coefficient with an increase on employment growth of 0.9% in the first buffer (1000-meter) c.p. The usage of public spaces like parks, plazas and streets, digital accessible (Wi-Fi) and open spaces with the creation of social interaction is robust for a larger area. Firms from inside as well as the surroundings of a knowledge location benefit

from these assets. A possible reason could be that a knowledge location serves as an important centre (node) for a larger area that attracts many people. Amenities & resources stay robust at the 2000-meter buffer with an increase in employment growth of 0.4% and 0.6%. This is clearly a positive externality of a knowledge location. The other physical assets which complement the physical element variable, such as place & building design and connectivity are not significant in any buffer radii for broad and narrow sense firms. This indicates the possibility that physical elements are primarily significant and important through the amenities & resources asset for the larger area and the knowledge location.

The image element shows that for any buffer radii there is a negative and significant effect (1% significance level) on employment growth for broad and narrow sense firms. It seems that a knowledge location provides a popular name, but does not provide any benefits to the area of marketing and communication channels. These outcomes are contradictory with the main model, which shows that image elements do not have any effect on employment growth for knowledge locations.

The main conclusion from this sensitivity analysis is that the robustness of the previous models does not hold. It is important to mention that amenities & resources are an important factor in physical elements and thus in the physical assets of knowledge locations.

Hypothesis 3

The findings above are inconclusive for answering hypothesis 3. *Knowledge locations with stronger physical assets foster stronger employment growth for firms.* The results are not clear and are sometimes contradictory. Physical elements support employment growth on knowledge locations for both broad and narrow sense firms, as these elements could foster an increase in quality of work environment or stimulate the local buzz. Public spaces where people from various firms can meet and interact, an open environment and good connectivity invite people to the knowledge location and improve working conditions. The other physical asset, image elements, does not provide any support to employment growth on knowledge locations.

The sensitivity analysis suggests that the robustness does not hold for physical elements and even indicates a negative and significant result for image elements, which is not in line with the outcomes of the main model. With this information, the hypothesis cannot be supported nor rejected.

5.4. Results hypothesis 4

To analyse hypothesis 4, which is defined as; *knowledge locations with stronger networking assets foster stronger employment growth of firms on geographically defined knowledge locations*, an appropriate model to analyse the survey outcomes should be found. Starting with multilevel modelling, the outcomes show that only 3,8% of the variance of employment growth can be explained by knowledge locations and that a linear model is more suitable than a multilevel model (hypothesis rejected) (appendix figure A.8).

Following these results, a linear regression model has been analysed to investigate if this model is more appropriate to analyse the outcomes of the survey. The linear regression is preferable since the factor analysis combines the two networking variables into one variable and loses the strength of a more detailed explanation. The two networking variables are local networking and global networking. Local networking consists of stimulating local buzz, meeting spots, shared-working spaces, meetings & events and same cultural traditions & habits of people. Global networking is about strategic partnerships, creating high level of trust between firms on-and off-side knowledge location, active involvement of firms on the knowledge location with partnerships.

	M14	M15
Firm specification	Broad	Narrow
Variables	Employment growth	Employment growth
Knowledge location with local networking (networking asset 1)	0.006**	0.008**
	(0.003)	(0.004)
Knowledge location with global networking (networking asset 2)	-0.005	-0.000
	(0.004)	(0.005)
Located on knowledge location during crisis (2008 – 2011)	-0.025**	-0.044**
	(0.010)	(0.021)
Located on knowledge location during late-crisis (2011 – 2015)	-0.026***	-0.061***
	(0.009)	(0.018)
Constant	0.039	0.077
	(0.042)	(0.058)
Observations	17,703	8,152
R-squared	0.024	0.031

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 13 – Regression models broad & narrow sense firms

Controlled for size classes, industries, provinces and male – appendix B.7

Local networking

Local networking has a positive effect on employment growth at knowledge locations for both broad and narrow sense firms. Broad sense firms benefit with 0.6% and knowledge intensive firms with 0.8% if the survey score increases with 1 point at the 5% significance level c.p. The range of the local networking assets in the survey score is 7 points, which indicates a difference of 4.2% and 5.6% on employment growth between the worst and best knowledge location with local networking assets. These outcomes suggest that stronger local networking is important at knowledge locations and becomes more important for knowledge intensive firms. This is likely, since knowledge intensive firms need exchange of knowledge and information in order to grow and become economically strong. The results are interesting since many researchers state that local networking is important in contributing to the strength of knowledge locations although it has never been examined in a statistical way.

Global networking

The outcomes in the table above indicate that the coefficients for global networking are not significant for broad and narrow sense firms. This suggests that global networking like strategic partnerships, creating high level of trust between firms on-and off-side knowledge location and active involvement of firms on the knowledge location with partnerships, does not provide any strength to the knowledge location and employment growth. A reason could be that a knowledge location is more focused on local networking or clustering of specific firms instead of connecting with firms and institutions outside their boundaries.

Networking assets buffer

The outcomes provided in the table above are evaluated on robustness by creating buffer radii of 1000 and 2000 meter. A linear regression model has been used corresponding with the statistical models of hypothesis 4.

	M14a	M15a	M14b	M15b
Firm specification	Broad	Narrow	Broad	Narrow
Buffer radii	1000m	2000m	1000m	2000m
Variables	Employment growth	Employment growth	Employment growth	Employment growth
Knowledge location with local networking	0.005	0.006**	-0.000	0.002
	(0.003)	(0.003)	(0.001)	(0.001)
Knowledge location with global networking	-0.008***	-0.010**	-0.002*	-0.005***
	(0.003)	(0.004)	(0.001)	(0.001)
Located on knowledge location during crisis (2008 – 2011)	-0.009	-0.018	-0.005	-0.016***
	(0.009)	(0.013)	(0.003)	(0.005)
Located on knowledge location during late-crisis (2011 – 2015)	-0.021***	-0.030*	-0.011***	-0.020***
	(0.007)	(0.015)	(0.003)	(0.006)
Constant	0.113***	-0.013	0.054***	0.032*
	(0.025)	(0.044)	(0.017)	(0.016)
Observations	13,053	5,151	63,022	19,672
R-squared	0.028	0.045	0.019	0.034

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 14 – Robustness analysis with different buffer radii

Controlled for size classes, industries, provinces and male – appendix B.8

The results suggest that knowledge intensive firms on a buffer of 1000-meter, profit from local networking with an increase of 0.6% on employment growth if the survey score increases with 1 point at the 5% significance level c.p. The coefficients of the broad sense firms indicate that these firms do not benefit from local networking at 1000-meter and 2000-meter. These outcomes are contradictive with the main model and do not support a robust outcome.

The outcomes of global networking indicate that all coefficients are negative and significant for broad and narrow sense firms at 1000-meter and 2000-meter buffer, which is again contradictory with the main model. Firms in a broader area do possibly not benefit at al from the global networking of knowledge locations. It could be that the firms in the surrounding lose employees to knowledge location based firms, due to better operational activities and strength that is initiated by for example strategic partnerships. The overall conclusion of the sensitivity analysis indicates that the outcomes are not robust.

Hypothesis 4

The findings above are inconclusive in answering the fourth hypothesis. *Knowledge locations with stronger networking assets foster stronger employment growth for firms*. The results show no clear evidence for supporting or rejecting the hypothesis and are sometimes even contradictory.

Firms on knowledge locations benefit only from local networking, such as stimulating local buzz, meeting spots, shared-working spaces, meetings & events and same cultural traditions & habits of people and this can be seen in an increase in employment growth. These positive outcomes, however, vanish with several buffer radii, which indicates that the results are not robust. The global networking assets have found to be not significant at knowledge locations and are negative in larger scale (buffers). The overall sensitivity analysis shows that local and global networking do not contribute to firms at and in the surrounding of knowledge locations, except for narrow sense firms at 1000-meter buffer.

These results indicate that networking assets are possibly not a key element at knowledge locations in fostering higher employment growth. Networking assets could be a preferable coincident of the other assets at knowledge locations, but do not stimulate employment growth as an important asset.

5.5. Results hypothesis 5

To analyse hypothesis 5, which is defined as; *knowledge locations with a mix of physical, economic and networks assets foster stronger employment growth of firms on geographically defined knowledge locations*, an appropriate model should be found. Starting with multilevel modelling, the outcomes show that only 2.2% of the variance of employment growth can be explained by knowledge locations and that a linear model is more suitable than a multilevel model (hypothesis rejected) (appendix figure A.11).

Following these results, a linear regression model has been analysed to investigate if this model is more appropriate in analysing the outcomes of the survey. The linear regression model shows that only the first economic asset is significant (appendix figure A.12). Since these outcomes are not favourable, factor analysis is applied by merging the assets together. The five variables that are used are producer amenities, consumer amenities (economic assets), physical elements, image elements (physical assets) and networking assets.

	M16a	M16b	M17a	M17b
Firm specification	Broad	Broad	Narrow	Narrow
Variables	Employment growth	Employment growth	Employment growth	Employment growth
Knowledge location with producer amenities	-0.000	-0.006	0.002	-0.002
	(0.004)	(0.004)	(0.003)	(0.003)
Knowledge location with consumer amenities	0.012**	0.009**	0.018**	0.021***
	(0.005)	(0.004)	(0.008)	(0.007)
Knowledge location with physical elements	0.011**	0.020***	0.006	0.013*
	(0.005)	(0.005)	(0.006)	(0.006)
Knowledge location with image elements	-0.010	0.008	-0.016*	-0.004
	(0.008)	(0.010)	(0.009)	(0.011)
Knowledge location with networking assets	-0.004	0.002	0.010	0.013
	(0.008)	(0.007)	(0.010)	(0.008)
Knowledge location with a combination of consumer amenities & physical elements		0.023***		0.016**
		(0.008)		(0.007)
Located on knowledge location during crisis (2008 – 2011)	-0.026**	-0.027**	-0.044**	-0.046**
	(0.010)	(0.010)	(0.021)	(0.021)
Located on knowledge location during late-crisis (2011 – 2015)	-0.027***	-0.029***	-0.062***	-0.065***
	(0.009)	(0.009)	(0.019)	(0.018)
Constant	0.059***	0.065**	0.145***	0.160***
	(0.021)	(0.024)	(0.034)	(0.034)
Observations	17,703	17,703	8,152	8,152
R-squared	0.025	0.025	0.032	0.032

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 15 – Regression models broad & narrow sense firms

Controlled for size classes, industries, provinces and male – appendix B.9

The outcomes from the table above show that only the coefficients of consumer amenities are significant in broad and narrow sense. This suggests that restaurants, coffee places, bars (cafés), hotels, retail shops and good public services are indeed important to stimulate employment growth if there is a mix of assets present at the knowledge location. A reason for these positive coefficients could be that physical elements contribute to better working conditions, which eventually leads to an increase in employment growth.

Physical elements are important for employment growth for firms in the broad sense. A growth of 1.1% (5% significant) if the survey score increases with 1 point, indicates that broad sense firms profit from physical elements while narrow sense firms do not, c.p. It could be that physical elements do not contribute to knowledge intensive firms, because of the focus on exchanging knowledge and information in a specific content and with less attention to amenities & resources, connectivity or the design of the knowledge location.

In addition to the consumer amenities and physical elements variables, an extra interaction variable has been created which indicates if these assets together provide a significant effect on employment growth at knowledge locations. The outcomes show a positive and significant (1% and 5% significance level) on employment growth at knowledge locations with an increase of 2.3% (broad) and 1,6% (narrow) if the survey score increases with 1 point. The overall range of this variable is 4.8, which shows that the employment growth could differ with around 11% and for narrow sense firms 7.7% c.p. for broad sense firms on the worst and best knowledge location. The combination of physical elements and consumer amenities is a good asset to create additional employment growth on knowledge locations. This new asset could contribute to the improvement of the quality of working conditions.

The image of knowledge location is negative for knowledge intensive firms. A possible reason of flaunting with their mainstream knowledge location based firms, which could lead to a negative image for possible employees. The networking assets are also not significant for broad and narrow sense firms.

An important node for the networking assets is that these assets do not foster any employment growth in context to consumer amenities and physical elements or a combination of these assets. This may indicate that there is no effect of the consumer amenities and physical elements on the stimulus of local networking/local buzz which have been stated as possible explanation in previous hypotheses. Consumer amenities and

physical elements could be only responsible for better working conditions and thus an increase in employment growth.
The overall conclusion is that consumer amenities and in narrow sense physical elements are important to stimulate employment growth on knowledge locations.

Buffer mixed assets

The outcomes provided in the table above are evaluated on robustness by creating buffer radii of 1000 and 2000 meter. A linear regression model has been used corresponding with the statistical models of hypothesis 5.

	M18a	M18b	M19a	M19b
Firm specification	Broad	Narrow	Broad	Narrow
Buffer radii	1000m	2000m	1000m	2000m
Variables	Employment growth	Employment growth	Employment growth	Employment growth
Knowledge location with innovation drivers (economic asset 1)	0.001	-0.016	-0.011**	0.002
	(0.018)	(0.030)	(0.005)	(0.019)
Knowledge location with higher education institutions (economic asset 2)	0.000	0.003	-0.002	-0.002
	(0.005)	(0.007)	(0.001)	(0.003)
Knowledge location with innovation cultivators (economic asset 3)	-0.002	0.002	0.008**	-0.002
	(0.015)	(0.022)	(0.003)	(0.012)
Knowledge location with consumer amenities (economic asset 4)	-0.003	-0.007	-0.019***	0.001
	(0.021)	(0.034)	(0.005)	(0.019)
Knowledge location with amenities & resources (physical asset 1)	0.007	-0.002	0.033***	0.004
	(0.026)	(0.038)	(0.006)	(0.022)
Knowledge location with place & building design (physical asset 2)	-0.013	-0.006	0.005*	-0.007
	(0.013)	(0.017)	(0.003)	(0.010)
Knowledge location with connectivity (physical asset 3)	0.001	0.001	-0.031***	-0.001
	(0.030)	(0.046)	(0.007)	(0.026)
Knowledge location with image (physical asset 4)	-0.005	-0.008	-0.037***	-0.003
	(0.036)	(0.054)	(0.008)	(0.030)
Knowledge location with local networking (networking assets 1)	0.012	0.012	-0.009***	0.008
	(0.014)	(0.017)	(0.003)	(0.010)
Knowledge location with global networking (networking assets 2)	-0.008	-0.000	0.036***	-0.007
	(0.042)	(0.065)	(0.009)	(0.037)
Located on knowledge location during crisis (2008 – 2011)	-0.009	-0.018	-0.006	-0.016**
	(0.010)	(0.014)	(0.003)	(0.006)
Located on knowledge location during late-crisis (2011 – 2015)	-0.020**	-0.030*	-0.011***	-0.020***
	(0.008)	(0.015)	(0.003)	(0.007)
Constant	0.127	0.048	0.200***	0.073
	(0.149)	(0.233)	(0.036)	(0.123)
Observations	13,053	5,151	63,022	19,672
R-squared	0.029	0.045	0.019	0.034

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 16 – Robustness analysis with different buffer radii

Controlled for size classes, industries, provinces and male – appendix B.10

The sensitivity analysis shows contradictive results compared to the main model. The only significant results can be found in the 2000-meter buffer for knowledge intensive firms.

Most of these significant coefficients are negative and not in line with the previous outcomes. The reason for these contradictive outcomes could be the large distance to the knowledge location, which leads to no or negative effects on employment growth.

Hypothesis 5

The findings above are inconclusive to answer the fifth hypothesis. *Knowledge locations with a mix of physical, economic and networks assets foster stronger employment growth of firms on geographically defined knowledge locations.* The outcomes suggest that in the mix of assets on knowledge locations, consumer amenities and physical elements generate enough strength to create employment growth. Bundling these assets together into a new asset provides a positive and significant (1% and 5%) effect on additional employment growth. The networking assets are found to be insignificant which indicates that the possible explanation from previous hypotheses, of creating and stimulating local buzz/local networking on knowledge locations by increasing consumer amenities and physical elements, is not supported.

The sensitivity analysis shows no significant effect for almost any buffer radii, except for the 2000-meter buffer with knowledge intensive firms, but these outcomes are contradictive with the main model, suggesting that the outcomes are not robust. The conclusion that can be drawn is that the results are inconclusive and could therefore not provide a clear answer to the hypothesis. The hypothesis cannot be supported nor rejected.

6. Synthesis

In this chapter, the most important insights from the previous chapter are discussed and reflected with the literature review.

The first hypothesis discusses if the *firms on geographically defined knowledge locations have stronger employment growth compared to firms at other locations*. The literature review reveals that most of the studies about knowledge locations are qualitative studies and analyse "popular" cases which most of the time have a positive outcome. The quantitative studies suggest also positive outcomes, but a strong conclusion about the effect of knowledge locations on employment growth could not be made, since there are too few quantitative studies. From the empirical analysis, it can be concluded that firms on geographically defined knowledge locations do not have a stronger employment growth compared to firms at other locations and thus does not correspond to the literature review. An important note is that within the time frame, the economic crisis has been taken place, which influences the results. Knowledge locations do foster a strong growth dynamic in different time periods. In economically vital time periods, firms at knowledge locations grow faster than firms localized somewhere else, but during economic downward periods, firms at knowledge locations decline faster than firms at other locations. Knowledge location based firms with different size classes indicate that small and large firms benefit from knowledge locations, but the middle size classes have to deal with additional decreases in employment growth. When comparing the broad sense firms to knowledge intensive firms (narrow sense), the outcomes show that narrow sense firms perform relatively better than broad sense firms.

The second hypothesis investigates if *knowledge locations with stronger economic assets foster stronger employment growth of firms on geographically defined knowledge locations.* According to the literature review, combining the elements together make the category economic assets an important asset in successfully creating a knowledge location. Attracting diverse high-tech and creative firms with leaders, the presence of an architectural structure of the location, links with universities and constructing consumer amenities will contribute to economically vital knowledge locations. In the empirical analysis, the first three economic assets categories are bundled into one category, namely producer amenities and indicate that these assets only weakly contribute to knowledge locations for knowledge intensive

firms. Consumer amenities provide a stronger contribution to employment growth at knowledge locations. These outcomes show opposite results compared to the literature review in which all categories contribute to knowledge locations. It can be concluded that especially stronger consumer amenities contribute to knowledge locations and that the other categories provide relatively weak strength to knowledge locations.

The third hypothesis states that *knowledge locations with stronger physical assets foster stronger employment growth of firms on geographically defined knowledge locations.* Amenities & resources, place & building design, connectivity and image are together forming the physical assets. Especially amenities & resources and connectivity are contributing to the physical assets and support power to knowledge locations. From the literature, it is clear that without a good structure of physical assets, the networking and economic assets will not properly be implemented in a knowledge location, facing a possible deterioration of the location. The empirical analysis connects with the results from the literature review. The analysis indicates that it is a selection of the assets that are beneficial for knowledge locations, specifically the physical elements, which is a bundle of the first three categories. The image element does not add strength to knowledge locations, which contradicts with the literature review. Overall stronger physical elements of knowledge locations provide benefits and strength to knowledge locations and employment growth.

The last type of assets on knowledge locations is networking assets, which consist of local and global networking and the hypothesis is; *knowledge locations with stronger networking assets foster stronger employment growth of firms on geographically defined knowledge locations.* The literature review states that the global pipelines (global) and local buzz (local) together form the networking assets. They are complementing each other to effectively creating a knowledge network where firms and people can exchange tacit knowledge and other types of information. These networking assets are also stimulated via economic and physical assets. The literature is clear that networking assets are needed to create a successful knowledge location where firms perform well compared to firms that are not present at these locations. The empirical analysis suggests that only local networking assets contribute to knowledge locations and employment growth. The effect is stronger for knowledge intensive firms. Global networking does not provide any significant effect on knowledge locations and is even negative for different buffer radii. Thus, the assumption in this case is that stronger local networking does contribute to knowledge locations. The

assumptions that have been described above should not weigh heavily, since the sensitivity analysis often shows contradictive or non-significant outcomes.

The last hypothesis combines the assets together into the following hypothesis; *knowledge locations with a mix of physical, economic and networks assets foster stronger employment growth of firms on geographically defined knowledge location.* The literature is clear that these three groups of assets together are important for a good functioning and economically vital knowledge location (Katz & Wagner, 2014). The empirical analysis indicates that only physical elements and consumer amenities are the important factors in the mix of assets. The literature review about networking assets reveals that physical elements and consumer amenities will contribute to local buzz and global pipelines, but since these assets do not show any significant result, there may be other reasons why these assets stimulate employment growth at knowledge locations (Bathelt, Malmberg, & Maskell, 2004). It could be that the physical elements and consumer amenities increase the level of working conditions/experience, which attract people to the knowledge locations. Nowadays people like to work at inspiring and beautiful places where they can stimulate personal growth and strength. The use of stronger physical assets and consumer amenities at knowledge locations could contribute to this empowerment.

7. Conclusion

7.1. Conclusion

In this research, it has been examined if firms on geographically defined knowledge locations grow faster than firms at other locations. The results from the empirical analysis suggest that in the overall time period (2003 – 2015) firms on knowledge locations do not have a higher employment growth than firms localized somewhere else and it can therefore be concluded that knowledge location based firms do not grow faster. An important note is that within the time frame, the economic crisis has been taken place, which influences the results. The outcomes also show that knowledge locations face a specific growth dynamic. During economically vital and stable periods, firms on knowledge locations grow faster than firms located elsewhere, but during economic downturn periods, these firms decline faster than firms at other locations.

From the use of a survey and their outcomes, the analysis indicates what type of assets are needed to stimulate faster growth at knowledge locations. The overall three categories of assets, economic, physical and networking are inconclusive to answer the hypothesises, but the underlying elements in these categories indicate that there are factors that do have a significant effect on knowledge locations and stimulate growth. Economic assets, which have been categorized into producer (innovation drivers, higher education institutions and innovation cultivators) and consumer amenities for the empirical analysis, suggest that stronger consumer amenities contribute to the strength of knowledge locations. The outcomes for physical assets show that stronger physical elements, such as amenities & resources, place & building design and connectivity also add strength to knowledge locations. The last type of asset, networking assets, indicates that especially stronger local networking does have a positive influence on knowledge locations. A combination of these assets indicate that only stronger consumer amenities and physical elements contribute to knowledge locations. Local networking has in this case no significant effect. These results suggest that physical elements and consumer amenities could positively stimulate the working conditions on knowledge locations, which could foster an increase in employment growth. The assumption that physical elements and consumer amenities increase the level of local networking on knowledge locations could not be proven. Overall it is important to

note that these results are not robust throughout different buffer radii, which shows that no great value should be attached to these assumptions.
A pleasant and beautiful designed knowledge location with good connectivity and amenities to consume, could foster an economically vital and good working climate and is certainly a recommendation for the creators/program makers of knowledge locations.

7.2. Limitations

Data limitations could influence the outcomes of the empirical analysis. The time period of the dataset, 2003 – 2015, includes the major economic crisis and influences the results. A dataset with a time period till the end of 2017 would be more suitable, since the additional years (2016 – 2017) are more economically stable. Another reason for extending the timeframe are the additional new knowledge locations that have been set up at the end of 2015 and the start of 2016. These new observations could enlarge the variance of the employment growth which explained by knowledge locations. The level of variance is another limitation in the analysis. The coefficient of the R-squared (0.05) is very low and means that a very small part of the variance is explained by knowledge locations. Thus, there are many other factors that are responsible for an effect on employment growth, which have not been covered by the empirical models.
The dataset of LISA is collected every year by sending out surveys. This type of gathering data could foster errors in the dataset, since the surveys may not be filled in properly or lack correct observations. These errors are not contributing to the strength of the empirical analysis.
The survey response rate was around 75% (38 of 51). The empirical analysis would be stronger (increase in level of significance) with a higher response rate. It is important to note that there was no pattern found in the 25% of people who have not responded.

7.3. Future research

As a follow-up research, it may be interesting to investigate the growth dynamics of knowledge locations in more detail. The empirical analysis shows that knowledge locations have a higher/lower employment growth during economically stable/downturn periods

compared to firms located somewhere else. It is interesting to investigate the underlying causes of this specific growth dynamic. Another opportunity is to continue with the same type of survey and expand the response rate, which could lead to more significant outcomes in an empirical analysis. Especially the factors (dummy variables) of the different categories of assets are interesting to examine, since these outcomes were not significant/lack observations and thus could not be added to the empirical analysis.

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9. Appendix

9.1. A - Stata Output

```
. hausman fe re
```

	Coefficients (b) fe	(B) re	(b−B) Difference	sqrt(diag(V_b−V_B)) S.E.
knowledgel~n	−.0128344	.0106101	−.0234445	.0022263
crisis	−.0168522	−.0054466	−.0114056	.0000794
postcrisis	−.0295296	−.0119845	−.0175451	.0001138
sizeclass2	.2412626	.062731	.1785316	.0003847
sizeclass3	.3915611	.0615299	.3300312	.0006037
sizeclass4	.5077006	.0523153	.4553854	.0008861
sizeclass5	.6037806	.0422132	.5615675	.00141
sizeclass6	.6745207	.0368404	.6376803	.0020892
male	.0008963	.0000291	.0008672	9.18e-06

```
                b = consistent under Ho and Ha; obtained from xtreg
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(9) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =   425796.24
                Prob>chi2 =      0.0000
```

Figure A.1 – Hausman test

```
. xtmixed diff_jobs EcoAssets_1 EcoAssets_2 EcoAssets_3 EcoAssets_4 crisis postcrisis sizeclass1 sizeclass2
> sizeclass3 sizeclass4 sizeclass5 sizeclass6 i.industry male || NaamKL:
note: sizeclass6 omitted because of collinearity

Performing EM optimization:

Performing gradient-based optimization:

Iteration 0:   log likelihood = -7741.1869
Iteration 1:   log likelihood = -7741.1827
Iteration 2:   log likelihood = -7741.1827

Computing standard errors:

Mixed-effects ML regression                     Number of obs     =     17,703
Group variable: NaamKL                          Number of groups  =         36

                                                Obs per group:
                                                              min =          1
                                                              avg =      491.8
                                                              max =      2,589

                                                Wald chi2(30)     =     383.89
Log likelihood = -7741.1827                     Prob > chi2       =     0.0000
```

diff_jobs	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
EcoAssets_1	-.0077227	.0061033	-1.27	0.206	-.019685	.0042397
EcoAssets_2	.0043132	.0038619	1.12	0.264	-.003256	.0118824
EcoAssets_3	.000865	.0037189	0.23	0.816	-.0064239	.008154
EcoAssets_4	.0022782	.00239	0.95	0.340	-.0024062	.0069625
crisis	-.0270377	.0084788	-3.19	0.001	-.0436559	-.0104195
postcrisis	-.0309833	.0083109	-3.73	0.000	-.0472723	-.0146943
sizeclass1	-.0699134	.0123889	-5.64	0.000	-.0941953	-.0456315
sizeclass2	.0551199	.0136465	4.04	0.000	.0283731	.0818666
sizeclass3	.0488186	.0142497	3.43	0.001	.0208897	.0767475
sizeclass4	-.0000868	.0142054	-0.01	0.995	-.0279289	.0277553
sizeclass5	-.0172039	.0179217	-0.96	0.337	-.0523297	.017922
sizeclass6	0	(omitted)				
industry						
B	-.0251277	.2662249	-0.09	0.925	-.546919	.4966636
C	-.0403408	.0261469	-1.54	0.123	-.0915878	.0109061
D	-.0440033	.057057	-0.77	0.441	-.155833	.0678265
E	-.0111408	.048446	-0.23	0.818	-.1060933	.0838116
F	-.0352734	.0282866	-1.25	0.212	-.0907142	.0201674
G	-.0312686	.0254066	-1.23	0.218	-.0810647	.0185274
H	-.0521996	.0297033	-1.76	0.079	-.1104171	.0060179
I	-.0335782	.0318004	-1.06	0.291	-.0959059	.0287494
J	-.0061537	.0256174	-0.24	0.810	-.0563629	.0440555
K	-.0669102	.0329794	-2.03	0.042	-.1315486	-.0022718
L	-.0044332	.0372817	-0.12	0.905	-.0775039	.0686375
M	.0040843	.0249625	0.16	0.870	-.0448413	.05301
N	-.0100386	.0281415	-0.36	0.721	-.0651949	.0451177
O	-.071761	.0571044	-1.26	0.209	-.1836836	.0401617
P	-.0546768	.0278665	-1.96	0.050	-.1092942	-.0000594
Q	-.0212747	.0275264	-0.77	0.440	-.0752255	.0326762
R	-.0257245	.0320243	-0.80	0.422	-.088491	.037042
S	-.0208899	.0301929	-0.69	0.489	-.0800669	.0382871
male	-.002753	.0097889	-0.28	0.779	-.0219389	.0164329
_cons	.1355038	.0539576	2.51	0.012	.0297489	.2412587

Random-effects Parameters	Estimate	Std. Err.	[95% Conf.	Interval]
NaamKL: Identity				
sd(_cons)	.013378	.0040911	.0073466	.0243609
sd(Residual)	.3745445	.0019914	.3706616	.3784681

```
LR test vs. linear model: chibar2(01) = 10.79          Prob >= chibar2 = 0.0005
```

Figure A.2 – Stata output multilevel modelling

```
. reg diff_jobs EcoAssets_1 EcoAssets_2 EcoAssets_3 EcoAssets_4 crisis postcrisis sizeclass2 sizeclass3 size
> class4 sizeclass5 sizeclass6 i.industry i.provcode male, cluster(NaamKL)

Linear regression                               Number of obs     =     17,703
                                                F(34, 35)         =          .
                                                Prob > F          =          .
                                                R-squared         =     0.0241
                                                Root MSE          =     .37506

                                   (Std. Err. adjusted for 36 clusters in NaamKL)
------------------------------------------------------------------------------
             |               Robust
   diff_jobs |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  EcoAssets_1 |   -.011301   .0043943    -2.57   0.015    -.020222     -.00238
  EcoAssets_2 |   .0060965   .0041695     1.46   0.153    -.002368     .014561
  EcoAssets_3 |   .0008393   .0037855     0.22   0.826    -.0068457    .0085242
  EcoAssets_4 |  -8.96e-06     .00196    -0.00   0.996    -.003988     .0039701
      crisis |   -.0239901   .0103669    -2.31   0.027    -.0450359    -.0029442
  postcrisis |   -.0242984   .0098409    -2.47   0.019    -.0442764    -.0043204
  sizeclass2 |    .122605   .0161075     7.61   0.000     .089905     .155305
  sizeclass3 |    .116134   .0142935     8.12   0.000     .0871166    .1451514
  sizeclass4 |   .0663286   .0087325     7.60   0.000     .0486007    .0840564
  sizeclass5 |   .0485404   .0113888     4.26   0.000     .0254199     .071661
  sizeclass6 |   .0662666    .015534     4.27   0.000     .0347308    .0978024
             |
    industry |
           B |   -.0185963   .0179298    -1.04   0.307    -.0549957    .0178031
           C |   -.0412319   .0144529    -2.85   0.007    -.0705729    -.0118909
           D |   -.0391044   .0494831    -0.79   0.435    -.1395604    .0613516
           E |   -.0074019   .0229656    -0.32   0.749    -.0540245    .0392207
           F |   -.0366949   .0229501    -1.60   0.119    -.0832861    .0098963
           G |   -.0357004   .0166015    -2.15   0.039    -.0694033    -.0019975
           H |   -.0535308   .0189489    -2.83   0.008     -.091999    -.0150625
           I |   -.0351286   .0255491    -1.37   0.178    -.0869961    .0167389
           J |   -.0088034   .0179876    -0.49   0.628    -.0453201    .0277134
           K |   -.0708019   .0247865    -2.86   0.007    -.1211212    -.0204827
           L |   -.0056821   .0292433    -0.19   0.847    -.0650492     .053685
           M |    .0033075    .017823     0.19   0.854    -.0328752    .0394902
           N |   -.0125839   .0174818    -0.72   0.476    -.0480738     .022906
           O |   -.0712858   .0368351    -1.94   0.061    -.1460651    .0034935
           P |    -.054801   .0193131    -2.84   0.008    -.0940086    -.0155934
           Q |   -.0214118   .0227363    -0.94   0.353    -.0675689    .0247453
           R |   -.0236923   .0187158    -1.27   0.214    -.0616875    .0143028
           S |   -.0238638   .0317985    -0.75   0.458    -.0884182    .0406906
             |
    provcode |
          23 |    .0427258   .0188475     2.27   0.030     .0044633    .0809882
          24 |   -.0246117   .0146503    -1.68   0.102    -.0543533      .00513
          25 |    .0088405   .0177508     0.50   0.622    -.0271957    .0448766
          27 |    .0260004    .017883     1.45   0.155     -.010304    .0623047
          28 |     .014489   .0174799     0.83   0.413    -.0209972    .0499751
          29 |    .0027331   .0176197     0.16   0.878    -.0330367    .0385029
          30 |    .0112954   .0215164     0.52   0.603    -.0323853     .054976
          31 |    .0123498   .0187221     0.66   0.514    -.0256581    .0503577
             |
        male |   -.0023038    .010336    -0.22   0.825    -.0232871    .0186794
       _cons |    .0774388   .0324893     2.38   0.023     .0114819    .1433956
------------------------------------------------------------------------------
```

Figure A.3 – Stata output linear regression

```
. factor EcoAssets_1 EcoAssets_2 EcoAssets_3 EcoAssets_4
(obs=26,869)

Factor analysis/correlation                      Number of obs    =     26,869
    Method: principal factors                    Retained factors =          2
    Rotation: (unrotated)                        Number of params =          6
```

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	1.60283	1.32460	1.0360	1.0360
Factor2	0.27823	0.35480	0.1798	1.2159
Factor3	-0.07657	0.18086	-0.0495	1.1664
Factor4	-0.25742	.	-0.1664	1.0000

LR test: independent vs. saturated: chi2(6) = 3.0e+04 Prob>chi2 = 0.0000

Factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Uniqueness
EcoAssets_1	0.6459	-0.2586	0.5159
EcoAssets_2	0.8234	0.1368	0.3033
EcoAssets_3	0.7125	0.0718	0.4872
EcoAssets_4	0.0076	0.4330	0.8125

Figure A.4 – Factor analysis economic assets

```
. xtmixed diff_jobs Physicalassets_1 Physicalassets_2 Physicalassets_3 Physicalassets_4 crisis postcrisis si
> zeclass1 sizeclass2 sizeclass3 sizeclass4 sizeclass5 sizeclass6 i.industry male || NaamKL:
note: sizeclass6 omitted because of collinearity

Performing EM optimization:

Performing gradient-based optimization:

Iteration 0:   log likelihood = -7740.1405
Iteration 1:   log likelihood = -7740.0987
Iteration 2:   log likelihood = -7740.0985

Computing standard errors:

Mixed-effects ML regression                     Number of obs     =     17,703
Group variable: NaamKL                          Number of groups  =         36

                                                Obs per group:
                                                              min =          1
                                                              avg =      491.8
                                                              max =      2,589

                                                Wald chi2(30)     =     390.36
Log likelihood = -7740.0985                     Prob > chi2       =     0.0000
```

diff_jobs	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Physicalassets_1	.0003454	.0042011	0.08	0.934	-.0078886	.0085794
Physicalassets_2	.0043875	.0040985	1.07	0.284	-.0036455	.0124204
Physicalassets_3	.0026097	.0033287	0.78	0.433	-.0039144	.0091339
Physicalassets_4	-.0013744	.0045038	-0.31	0.760	-.0102018	.0074529
crisis	-.0276493	.0084661	-3.27	0.001	-.0442425	-.0110561
postcrisis	-.0316361	.0082282	-3.84	0.000	-.0477631	-.0155091
sizeclass1	-.0697148	.0123687	-5.64	0.000	-.0939569	-.0454726
sizeclass2	.0557682	.0136306	4.09	0.000	.0290527	.0824837
sizeclass3	.0493031	.0142254	3.47	0.001	.0214218	.0771845
sizeclass4	.001118	.0141939	0.08	0.937	-.0267016	.0289375
sizeclass5	-.0159219	.0179229	-0.89	0.374	-.05105	.0192063
sizeclass6	0	(omitted)				
industry						
B	-.030591	.266215	-0.11	0.909	-.5523628	.4911808
C	-.0411002	.0261031	-1.57	0.115	-.0922612	.0100609
D	-.0533133	.0568869	-0.94	0.349	-.1648095	.058183
E	-.0136129	.0484314	-0.28	0.779	-.1085367	.081311
F	-.0346785	.0282722	-1.23	0.220	-.0900909	.0207339
G	-.0297466	.0253706	-1.17	0.241	-.0794721	.0199789
H	-.0518705	.0297034	-1.75	0.081	-.1100881	.0063471
I	-.0344317	.0317783	-1.08	0.279	-.0967161	.0278527
J	-.0087357	.0256035	-0.34	0.733	-.0589177	.0414463
K	-.0692961	.0329652	-2.10	0.036	-.1339067	-.0046855
L	-.0051782	.0372576	-0.14	0.889	-.0782017	.0678454
M	.0026766	.0249306	0.11	0.915	-.0461864	.0515396
N	-.0110317	.0281187	-0.39	0.695	-.0661433	.0440798
O	-.0745504	.0570771	-1.31	0.192	-.1864196	.0373187
P	-.0557825	.0278299	-2.00	0.045	-.1103282	-.0012368
Q	-.0222648	.0275014	-0.81	0.418	-.0761666	.0316369
R	-.027128	.0319821	-0.85	0.396	-.0898116	.0355557
S	-.0210486	.0301591	-0.70	0.485	-.0801593	.038062
male	-.0016511	.0097939	-0.17	0.866	-.0208468	.0175446
_cons	.0876437	.0433743	2.02	0.043	.0026316	.1726558

Random-effects Parameters	Estimate	Std. Err.	[95% Conf.	Interval]
NaamKL: Identity				
sd(_cons)	.010904	.0047773	.0046201	.0257348
sd(Residual)	.3745583	.0019918	.3706747	.3784826

```
LR test vs. linear model: chibar2(01) = 3.30          Prob >= chibar2 = 0.0346
```

Figure A.5 – Stata output multilevel modelling

```
. reg diff_jobs Physicalassets_1 Physicalassets_2 Physicalassets_3 Physicalassets_4 crisis postcrisis sizecl
> ass2 sizeclass3 sizeclass4 sizeclass5 sizeclass6 i.industry i.provcode male, cluster(NaamKL)

Linear regression                               Number of obs     =     17,703
                                                F(34, 35)         =          .
                                                Prob > F          =          .
                                                R-squared         =     0.0245
                                                Root MSE          =     .37498

                                   (Std. Err. adjusted for 36 clusters in NaamKL)
------------------------------------------------------------------------------
             |               Robust
   diff_jobs |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
Physicalassets_1 |   .0013032   .0050819     0.26   0.799    -.0090136    .0116201
Physicalassets_2 |   .0061753   .0038624     1.60   0.119    -.0016658    .0140164
Physicalassets_3 |   .0001298   .0042412     0.03   0.976    -.0084803    .0087398
Physicalassets_4 |  -.0063773   .0044852    -1.42   0.164    -.0154827    .0027281
          crisis |  -.0254008   .0098237    -2.59   0.014     -.045344   -.0054575
      postcrisis |  -.0273037   .0080605    -3.39   0.002    -.0436674     -.01094
      sizeclass2 |   .1245012   .0156984     7.93   0.000     .0926319    .1563706
      sizeclass3 |   .1177601   .0139037     8.47   0.000     .0895342    .1459861
      sizeclass4 |   .0692926   .0088083     7.87   0.000     .0514107    .0871744
      sizeclass5 |   .0519632   .0112637     4.61   0.000     .0290967    .0748297
      sizeclass6 |   .0678085   .0152963     4.43   0.000     .0367554    .0988616
                 |
        industry |
               B |  -.0269527   .0192092    -1.40   0.169    -.0659494     .012044
               C |  -.0429733   .0146466    -2.93   0.006    -.0727074   -.0132391
               D |  -.0484483   .0498986    -0.97   0.338    -.1497479    .0528514
               E |  -.0128294   .0254436    -0.50   0.617    -.0644827     .038824
               F |   -.035397   .0222584    -1.59   0.121     -.080584      .00979
               G |  -.0321223    .016179    -1.99   0.055    -.0649674    .0007229
               H |   -.052566   .0189147    -2.78   0.009    -.0909649    -.014167
               I |  -.0372739   .0255802    -1.46   0.154    -.0892045    .0146567
               J |  -.0130706   .0176243    -0.74   0.463    -.0488499    .0227087
               K |  -.0753924   .0249965    -3.02   0.005     -.126138   -.0246468
               L |  -.0085607   .0300071    -0.29   0.777    -.0694784    .0523569
               M |  -.0000644   .0177892    -0.00   0.997    -.0361784    .0360495
               N |  -.0149737   .0173756    -0.86   0.395     -.050248    .0203007
               O |  -.0797858   .0377489    -2.11   0.042    -.1564202   -.0031515
               P |  -.0584616   .0193099    -3.03   0.005    -.0976627   -.0192605
               Q |  -.0238413   .0227746    -1.05   0.302    -.0700761    .0223935
               R |  -.0281204    .018897    -1.49   0.146    -.0664833    .0102425
               S |  -.0245439   .0322041    -0.76   0.451    -.0899217    .0408339
                 |
        provcode |
              23 |   .0240201   .0164591     1.46   0.153    -.0093937    .0574339
              24 |  -.0461076   .0374378    -1.23   0.226    -.1221104    .0298951
              25 |  -.0144665   .0183646    -0.79   0.436    -.0517486    .0228156
              27 |   .0114138   .0162969     0.70   0.488    -.0216707    .0444982
              28 |   .0002823   .0217366     0.01   0.990    -.0438455     .04441
              29 |  -.0016238   .0154885    -0.10   0.917    -.0330672    .0298196
              30 |   .0013434   .0198243     0.07   0.946    -.0389022    .0415889
              31 |  -.0136022   .0184073    -0.74   0.465     -.050971    .0237666
                 |
            male |  -.0015429   .0100873    -0.15   0.879    -.0220212    .0189354
           _cons |   .0558049   .0458944     1.22   0.232    -.0373657    .1489756
------------------------------------------------------------------------------
```

Figure A.6 – Stata output linear regression

```
. factor Physicalassets_1 Physicalassets_2 Physicalassets_3 Physicalassets_4
(obs=26,869)

Factor analysis/correlation                      Number of obs    =     26,869
    Method: principal factors                    Retained factors =          2
    Rotation: (unrotated)                        Number of params =          6
```

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	2.36221	2.19494	1.0283	1.0283
Factor2	0.16727	0.25314	0.0728	1.1011
Factor3	-0.08586	0.06050	-0.0374	1.0637
Factor4	-0.14637	.	-0.0637	1.0000

LR test: independent vs. saturated: chi2(6) = 6.3e+04 Prob>chi2 = 0.0000

Factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Uniqueness
Physicalas~1	0.9173	0.0734	0.1531
Physicalas~2	0.8894	-0.0094	0.2088
Physicalas~3	0.7816	-0.2230	0.3394
Physicalas~4	0.3445	0.3348	0.7692

Figure A.7 – Factor analysis physical assets

```
. xtmixed diff_jobs Networkingassets_1 Networkingassets_2 crisis postcrisis sizeclass1 sizeclass2 sizeclass3
>  sizeclass4 sizeclass5 sizeclass6 i.industry male || NaamKL:
note: sizeclass6 omitted because of collinearity

Performing EM optimization:

Performing gradient-based optimization:

Iteration 0:   log likelihood = -7742.2289
Iteration 1:   log likelihood = -7742.2268
Iteration 2:   log likelihood = -7742.2268

Computing standard errors:

Mixed-effects ML regression                     Number of obs     =     17,703
Group variable: NaamKL                          Number of groups  =         36

                                                Obs per group:
                                                              min =          1
                                                              avg =      491.8
                                                              max =      2,589

                                                Wald chi2(28)     =     380.29
Log likelihood = -7742.2268                     Prob > chi2       =     0.0000
```

diff_jobs	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Networkingassets_1	.0038865	.0028089	1.38	0.166	-.0016189	.0093918
Networkingassets_2	-.0002685	.0043192	-0.06	0.950	-.008734	.008197
crisis	-.0277983	.0084968	-3.27	0.001	-.0444517	-.0111449
postcrisis	-.0317179	.0082971	-3.82	0.000	-.0479799	-.0154559
sizeclass1	-.0708088	.0124007	-5.71	0.000	-.0951136	-.0465039
sizeclass2	.0546012	.0136492	4.00	0.000	.0278491	.0813532
sizeclass3	.0483638	.0142518	3.39	0.001	.0204307	.0762969
sizeclass4	-.0004431	.0142091	-0.03	0.975	-.0282923	.0274061
sizeclass5	-.0173267	.0179269	-0.97	0.334	-.0524627	.0178093
sizeclass6	0	(omitted)				
industry						
B	-.0279118	.2662321	-0.10	0.917	-.549717	.4938935
C	-.0396895	.0261317	-1.52	0.129	-.0909068	.0115277
D	-.0465308	.0569166	-0.82	0.414	-.1580852	.0650235
E	-.012725	.0484372	-0.26	0.793	-.1076601	.0822101
F	-.0344962	.0282852	-1.22	0.223	-.0899341	.0209418
G	-.0295288	.0254133	-1.16	0.245	-.0793379	.0202803
H	-.0526247	.0297156	-1.77	0.077	-.1108662	.0056167
I	-.033392	.0317974	-1.05	0.294	-.0957138	.0289297
J	-.0062241	.0256483	-0.24	0.808	-.0564938	.0440456
K	-.0668178	.0329998	-2.02	0.043	-.1314961	-.0021394
L	-.0036039	.0372857	-0.10	0.923	-.0766826	.0694748
M	.0047948	.0249858	0.19	0.848	-.0441764	.053766
N	-.009395	.0281535	-0.33	0.739	-.0645748	.0457848
O	-.0711148	.0571219	-1.24	0.213	-.1830717	.040842
P	-.0528547	.0278639	-1.90	0.058	-.107467	.0017575
Q	-.0203532	.027539	-0.74	0.460	-.0743287	.0336223
R	-.0255103	.0320222	-0.80	0.426	-.0882726	.037252
S	-.0198789	.0301967	-0.66	0.510	-.0790634	.0393057
male	-.0020957	.0097963	-0.21	0.831	-.0212961	.0171047
_cons	.1036473	.0390608	2.65	0.008	.0270895	.1802051

Random-effects Parameters	Estimate	Std. Err.	[95% Conf.	Interval]
NaamKL: Identity				
sd(_cons)	.0147608	.0043495	.008285	.0262983
sd(Residual)	.374546	.0019916	.3706629	.3784698

LR test vs. linear model: chibar2(01) = 12.06 Prob >= chibar2 = 0.0003

Figure A.8 – Stata output multilevel modelling

```
. factor Networkingassets_1 Networkingassets_2
(obs=26,869)

Factor analysis/correlation                      Number of obs    =     26,869
    Method: principal factors                    Retained factors =          1
    Rotation: (unrotated)                        Number of params =          1

    ------------------------------------------------------------------------------
          Factor  |   Eigenvalue   Difference        Proportion   Cumulative
    --------------+---------------------------------------------------------------
         Factor1  |      0.79527      1.04477            1.4571       1.4571
         Factor2  |     -0.24950            .           -0.4571       1.0000
    ------------------------------------------------------------------------------
    LR test: independent vs. saturated:  chi2(1)  = 8561.97 Prob>chi2 = 0.0000

Factor loadings (pattern matrix) and unique variances

    -------------------------------------
        Variable |    Factor1 |  Uniqueness
    -------------+-----------+-------------
    Networking~1 |     0.6306 |      0.6024
    Networking~2 |     0.6306 |      0.6024
    -------------------------------------
```

Figure A.9 – Factor analysis networking assets

```
. reg diff_jobs Networking crisis postcrisis sizeclass2 sizeclass3 sizeclass4 sizeclass5 sizeclass6 i.indust
> ry i.provcode male, cluster(NaamKL)

Linear regression                               Number of obs     =     17,703
                                                F(32, 35)         =          .
                                                Prob > F          =          .
                                                R-squared         =     0.0238
                                                Root MSE          =     .37508

                                   (Std. Err. adjusted for 36 clusters in NaamKL)
------------------------------------------------------------------------------
             |               Robust
   diff_jobs |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  Networking |   .0059669   .0084404     0.71   0.484    -.0111681    .0231019
      crisis |  -.0238471   .0101353    -2.35   0.024    -.0444228   -.0032715
  postcrisis |  -.0234843   .0094421    -2.49   0.018    -.0426529   -.0043158
  sizeclass2 |   .1222425   .0156386     7.82   0.000     .0904945    .1539905
  sizeclass3 |   .1160518   .0138029     8.41   0.000     .0880304    .1440732
  sizeclass4 |   .0651416   .0083154     7.83   0.000     .0482604    .0820228
  sizeclass5 |   .0474943   .0112463     4.22   0.000      .024663    .0703255
  sizeclass6 |   .0653247   .0151091     4.32   0.000     .0346515    .0959979
             |
    industry |
           B |  -.0248995     .02076    -1.20   0.238    -.0670446    .0172456
           C |   -.042438    .014608    -2.91   0.006    -.0720938   -.0127821
           D |  -.0407422   .0490623    -0.83   0.412     -.140344    .0588595
           E |  -.0099905    .024482    -0.41   0.686    -.0596916    .0397106
           F |  -.0367229   .0233201    -1.57   0.124    -.0840652    .0106195
           G |  -.0358217   .0169335    -2.12   0.042    -.0701986   -.0014448
           H |  -.0546803   .0196472    -2.78   0.009    -.0945662   -.0147943
           I |  -.0342039   .0255255    -1.34   0.189    -.0860235    .0176157
           J |  -.0119044   .0180944    -0.66   0.515    -.0486381    .0248293
           K |   -.072908   .0249874    -2.92   0.006    -.1236353   -.0221808
           L |  -.0066892   .0291959    -0.23   0.820    -.0659601    .0525817
           M |   .0026397   .0178094     0.15   0.883    -.0335152    .0387947
           N |  -.0139422   .0177436    -0.79   0.437    -.0499637    .0220792
           O |  -.0715835   .0361531    -1.98   0.056    -.1449782    .0018111
           P |  -.0532547   .0196134    -2.72   0.010     -.093072   -.0134373
           Q |  -.0210863   .0226777    -0.93   0.359    -.0671246    .0249519
           R |  -.0256605   .0188562    -1.36   0.182    -.0639405    .0126196
           S |  -.0212281   .0319866    -0.66   0.511    -.0861644    .0437081
             |
    provcode |
          23 |    .030991   .0138266     2.24   0.031     .0029216    .0590604
          24 |  -.0219651   .0156903    -1.40   0.170    -.0538182     .009888
          25 |   .0011808    .020006     0.06   0.953    -.0394335    .0417952
          27 |   .0225812    .017023     1.33   0.193    -.0119772    .0571397
          28 |   .0153195   .0158141     0.97   0.339    -.0167848    .0474239
          29 |  -.0075508   .0132197    -0.57   0.572    -.0343883    .0192867
          30 |   .0027783     .02195     0.13   0.900    -.0417826    .0473392
          31 |   .0030082   .0136137     0.22   0.826     -.024629    .0306454
             |
        male |  -.0003768   .0100208    -0.04   0.970    -.0207201    .0199664
       _cons |   .0477087   .0229249     2.08   0.045     .0011687    .0942488
------------------------------------------------------------------------------
```

Figure A.10 – Stata output linear regression

```
. xtmixed diff_jobs EcoAssets_1 EcoAssets_2 EcoAssets_3 EcoAssets_4 Physicalassets_1 Physicalassets_2 Ph
> ysicalassets_3 Physicalassets_4 Networkingassets_1 Networkingassets_2 crisis postcrisis sizeclass1 siz
> eclass2 sizeclass3 sizeclass4 sizeclass5 sizeclass6 i.industry male || NaamKL:
note: sizeclass6 omitted because of collinearity

Performing EM optimization:

Performing gradient-based optimization:

Iteration 0:   log likelihood = -7737.9968
Iteration 1:   log likelihood = -7737.8913
Iteration 2:   log likelihood = -7737.8904
Iteration 3:   log likelihood = -7737.8904

Computing standard errors:

Mixed-effects ML regression                     Number of obs     =     17,703
Group variable: NaamKL                          Number of groups  =         36

                                                Obs per group:
                                                              min =          1
                                                              avg =      491.8
                                                              max =      2,589

                                                Wald chi2(36)     =     402.72
Log likelihood = -7737.8904                     Prob > chi2       =     0.0000
```

diff_jobs	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
EcoAssets_1	-.0086141	.0057712	-1.49	0.136	-.0199254	.0026973
EcoAssets_2	.0055444	.0036897	1.50	0.133	-.0016874	.0127761
EcoAssets_3	-.0015419	.0036594	-0.42	0.673	-.0087141	.0056303
EcoAssets_4	.0022768	.0029318	0.78	0.437	-.0034695	.0080231
Physicalassets_1	-.0037441	.005388	-0.69	0.487	-.0143043	.0068162
Physicalassets_2	.0070316	.004597	1.53	0.126	-.0019783	.0160415
Physicalassets_3	.0039175	.0037965	1.03	0.302	-.0035235	.0113584
Physicalassets_4	.0000609	.0053367	0.01	0.991	-.0103988	.0105207
Networkingassets_1	-.0009344	.003129	-0.30	0.765	-.0070671	.0051984
Networkingassets_2	-.0007763	.0049189	-0.16	0.875	-.0104171	.0088645
crisis	-.0280983	.00848	-3.31	0.001	-.0447188	-.0114777
postcrisis	-.0323281	.0082964	-3.90	0.000	-.0485887	-.0160676
sizeclass1	-.069081	.0123594	-5.59	0.000	-.093305	-.044857
sizeclass2	.057115	.0136266	4.19	0.000	.0304074	.0838227
sizeclass3	.0508846	.0142191	3.58	0.000	.0230158	.0787535
sizeclass4	.0026975	.014193	0.19	0.849	-.0251203	.0305152
sizeclass5	-.0147315	.0179226	-0.82	0.411	-.0498592	.0203962
sizeclass6	0	(omitted)				
industry						
B	-.0294201	.2662093	-0.11	0.912	-.5511807	.4923405
C	-.0409588	.0261079	-1.57	0.117	-.0921293	.0102116
D	-.0481212	.0570951	-0.84	0.399	-.1600256	.0637832
E	-.0134344	.0484666	-0.28	0.782	-.1084273	.0815585
F	-.0356039	.0282713	-1.26	0.208	-.0910147	.019807
G	-.0303754	.0253833	-1.20	0.231	-.0801258	.0193749
H	-.0527746	.0297013	-1.78	0.076	-.110988	.0054389
I	-.035622	.0317996	-1.12	0.263	-.0979481	.0267041
J	-.0074416	.0256412	-0.29	0.772	-.0576973	.0428142
K	-.0688922	.0329719	-2.09	0.037	-.1335159	-.0042684
L	-.0054312	.0372528	-0.15	0.884	-.0784453	.0675829
M	.0029304	.0249712	0.12	0.907	-.0460123	.0518732
N	-.0107533	.028118	-0.38	0.702	-.0658635	.044357
O	-.0753568	.0570889	-1.32	0.187	-.1872491	.0365354
P	-.0586446	.0278799	-2.10	0.035	-.1132881	-.0040011
Q	-.0227793	.027511	-0.83	0.408	-.0766997	.0311412
R	-.028143	.0320339	-0.88	0.380	-.0909284	.0346423
S	-.0224273	.0301755	-0.74	0.457	-.0815703	.0367156
male	-.0012538	.0098089	-0.13	0.898	-.0204788	.0179713
_cons	.1106395	.0559349	1.98	0.048	.0010091	.2202699

Random-effects Parameters	Estimate	Std. Err.	[95% Conf.	Interval]
NaamKL: Identity				
sd(_cons)	.008271	.0045319	.0028259	.0242078
sd(Residual)	.3745492	.0019915	.3706662	.3784729

LR test vs. linear model: chibar2(01) = 1.67 Prob >= chibar2 = 0.0978

Figure A.11 – Stata output multilevel modelling

```
. reg diff_jobs EcoAssets_1 EcoAssets_2 EcoAssets_3 EcoAssets_4 Physicalassets_1 Physicalassets_2 Physic
> alassets_3 Physicalassets_4 Networkingassets_1 Networkingassets_2 crisis postcrisis sizeclass2 sizecla
> ss3 sizeclass4 sizeclass5 sizeclass6 i.industry i.provcode male, cluster(NaamKL)

Linear regression                               Number of obs     =     17,703
                                                F(34, 35)         =          .
                                                Prob > F          =          .
                                                R-squared         =     0.0248
                                                Root MSE          =     .37499

                                   (Std. Err. adjusted for 36 clusters in NaamKL)
------------------------------------------------------------------------------
             |               Robust
   diff_jobs |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  EcoAssets_1 |  -.0126088   .0070642    -1.78   0.083    -.0269499    .0017323
  EcoAssets_2 |      .0066   .0052552     1.26   0.217    -.0040687    .0172687
  EcoAssets_3 |  -.0018608   .0044428    -0.42   0.678    -.0108802    .0071586
  EcoAssets_4 |   .0027839   .0029637     0.94   0.354    -.0032328    .0088005
Physicalassets_1 |  -.0096198   .0089552    -1.07   0.290    -.0277999    .0085602
Physicalassets_2 |   .0065495   .0097675     0.67   0.507    -.0132796    .0263785
Physicalassets_3 |   .0080766   .0081727     0.99   0.330    -.0085149    .0246681
Physicalassets_4 |   .0050191   .0125259     0.40   0.691    -.0204099    .0304482
Networkingassets_1 |   .0022178    .00955     0.23   0.818    -.0171696    .0216053
Networkingassets_2 |  -.0064312   .0113849    -0.56   0.576    -.0295438    .0166815
      crisis |  -.0258557   .0102009    -2.53   0.016    -.0465645   -.0051468
  postcrisis |   -.029002    .008813    -3.29   0.002    -.0468933   -.0111107
  sizeclass2 |   .1251765    .015976     7.84   0.000     .0927435    .1576094
  sizeclass3 |   .1182381   .0143212     8.26   0.000     .0891644    .1473117
  sizeclass4 |   .0700588   .0092775     7.55   0.000     .0512244    .0888932
  sizeclass5 |   .0530605   .0116714     4.55   0.000     .0293663    .0767548
  sizeclass6 |   .0677609   .0160751     4.22   0.000     .0351267    .1003951
             |
    industry |
           B |  -.0303728    .018097    -1.68   0.102    -.0671116     .006366
           C |  -.0449266   .0149563    -3.00   0.005    -.0752895   -.0145637
           D |  -.0477284   .0503436    -0.95   0.350    -.1499313    .0544745
           E |  -.0145346   .0258976    -0.56   0.578    -.0671096    .0380404
           F |  -.0376593   .0228977    -1.64   0.109    -.0841441    .0088254
           G |   -.034684   .0167474    -2.07   0.046    -.0686829    -.000685
           H |  -.0547773   .0194281    -2.82   0.008    -.0942185   -.0153361
           I |  -.0409403   .0266452    -1.54   0.133     -.095033    .0131524
           J |  -.0132355   .0183549    -0.72   0.476    -.0504979    .0240269
           K |   -.076304   .0254537    -3.00   0.005    -.1279776   -.0246303
           L |  -.0104734   .0302565    -0.35   0.731    -.0718973    .0509505
           M |  -.0025455   .0185538    -0.14   0.892    -.0402116    .0351207
           N |  -.0158286   .0177692    -0.89   0.379    -.0519021    .0202448
           O |  -.0809558   .0372573    -2.17   0.037    -.1565922   -.0053195
           P |  -.0639353   .0200926    -3.18   0.003    -.1047254   -.0231451
           Q |  -.0276805   .0232552    -1.19   0.242    -.0748911    .0195301
           R |  -.0319863   .0190512    -1.68   0.102    -.0706624    .0066897
           S |  -.0273484   .0326789    -0.84   0.408      -.09369    .0389933
             |
    provcode |
          23 |   .0459227   .0416654     1.10   0.278    -.0386626     .130508
          24 |   .0494913   .1281272     0.39   0.702    -.2106208    .3096033
          25 |    .009405   .0433809     0.22   0.830    -.0786629    .0974729
          27 |   .0116102   .0272989     0.43   0.673    -.0438095    .0670298
          28 |   .0204255   .0394277     0.52   0.608     -.059617    .1004679
          29 |    -.00784   .0236366    -0.33   0.742    -.0558248    .0401447
          30 |   .0135284   .0402306     0.34   0.739    -.0681442    .0952009
          31 |   .0119655   .0599584     0.20   0.843    -.1097564    .1336875
             |
        male |  -.0016571   .0104375    -0.16   0.875    -.0228463    .0195321
       _cons |   .0487533   .0491808     0.99   0.328     -.051089    .1485957
------------------------------------------------------------------------------
```

Figure A.12 – Stata output linear regression

9.2. B – Full regression tables

	(M5) - FE	(M6) – FE	(M7) - FE	(M8) - FE	(M9) – Pooled OLS
Variables	Employment growth	Employment growth	Employment growth	Employment growth	Employment growth
Firms located on a knowledge location	-0.014***	0.063***	0.003	0.079***	0.017**
	(0.005)	(0.011)	(0.005)	(0.011)	(0.007)
Crisis (2008 – 2011)	-0.019***	-0.019***	-0.019***	-0.019***	-0.009***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Late-crisis (2012 – 2015)	-0.031***	-0.031***	-0.031***	-0.031***	-0.014***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Located on knowledge location during crisis		-0.054***		-0.052***	-0.005
		(0.010)		(0.010)	(0.009)
Located on knowledge location during late-crisis		-0.093***		-0.092***	-0.012
		(0.011)		(0.011)	(0.008)
Size class 2 (5 – 10 jobs)	0.227***	0.227***	0.227***	0.227***	0.077***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Size class 3 (10 – 20 jobs)	0.353***	0.354***	0.354***	0.355***	0.074***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)
Size class 4 (20 – 50 jobs)	0.453***	0.453***	0.454***	0.455***	0.059***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.001)
Size class 5 (50 – 100 jobs)	0.544***	0.545***	0.545***	0.546***	0.045***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.002)
Size class 6 (> 100 jobs)	0.642***	0.643***	0.643***	0.644***	0.037***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.001)
Firms in size class 2 located on knowledge location			-0.021	-0.025**	0.022**
			(0.013)	(0.013)	(0.009)

Firms in size class 3 located on knowledge location			-0.065***	-0.065***	0.021**
			(0.017)	(0.017)	(0.009)
Firms in size class 4 located on knowledge location			-0.077***	-0.073***	0.005
			(0.018)	(0.018)	(0.008)
Firms in size class 5 located on knowledge location			-0.086***	-0.080***	0.011
			(0.024)	(0.023)	(0.013)
Firms in size class 6 located on knowledge location			-0.058***	-0.050***	-0.021**
			(0.019)	(0.019)	(0.009)
Electricity, gas, steam and air conditioning supply					0.010***
					(0.003)
Information and communication					0.015***
					(0.001)
Financial institutions					-0.007***
					(0.001)
Consultancy, research and other specialized business services					0.011***
					(0.000)
Province of Friesland					-0.007***
					(0.001)
Province of Drenthe					-0.005***
					(0.001)
Province of Overijssel					0.001
					(0.001)
Province of Flevoland					0.000
					(0.001)

Province of Gelderland					0.004***
					(0.001)
Province of Utrecht					-0.006***
					(0.001)
Province of Noord-Holland					-0.007***
					(0.001)
Province of Zuid-Holland					-0.007***
					(0.001)
Province of Zeeland					-0.004***
					(0.001)
Province of Noord-Brabant					-0.006***
					(0.001)
Province of Limburg					-0.009***
					(0.001)
Percentage of jobs executed by male	-0.113***	-0.113***	-0.113***	-0.113***	-0.014***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.000)
Constant	0.077***	0.077***	0.077***	0.076***	0.023***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	2,524,926	2,524,926	2,524,926	2,524,926	2,524,926
R-squared	0.045	0.045	0.045	0.045	0.017
Number of lisacode	479,664	479,664	479,664	479,664	

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B.1 – Regression models narrow sense firms

	M2a	M2b	M2c	M6a	M6b	M6c
Firms specification	Broad	Broad	Broad	Narrow	Narrow	Narrow
Buffers	Reference	1000m	2000m	Reference	1000m	2000m
Variables	Employment growth	Employment growth	Employment growth	Employment growth	Employment growth	Employment growth
Firms located on a knowledge location	0.033***	0.021***	0.003	0.063***	0.046***	0.022***
	(0.007)	(0.006)	(0.002)	(0.011)	(0.010)	(0.005)

Crisis (2008 – 2011)	-0.017***	-0.017***	-0.017***	-0.019***	-0.019***	-0.019***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Late-crisis (2012 – 2015)	-0.030***	-0.030***	-0.030***	-0.031***	-0.031***	-0.031***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Located on knowledge location during crisis	-0.035***	-0.017***	-0.004*	-0.054***	-0.037***	-0.019***
	(0.007)	(0.006)	(0.002)	(0.010)	(0.010)	(0.004)
Located on knowledge location during late-crisis	-0.055***	-0.033***	-0.009***	-0.093***	-0.063***	-0.031***
	(0.007)	(0.006)	(0.002)	(0.011)	(0.010)	(0.005)
Size class 2 (5 – 10 jobs)	0.238***	0.238***	0.238***	0.227***	0.227***	0.227***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Size class 3 (10 – 20 jobs)	0.390***	0.390***	0.390***	0.354***	0.353***	0.353***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.003)	(0.003)
Size class 4 (20 – 50 jobs)	0.512***	0.512***	0.512***	0.453***	0.453***	0.453***
	(0.002)	(0.002)	(0.002)	(0.004)	(0.004)	(0.004)
Size class 5 (50 – 100 jobs)	0.625***	0.625***	0.625***	0.545***	0.544***	0.544***
	(0.002)	(0.002)	(0.002)	(0.006)	(0.006)	(0.006)
Size class 6 (> 100 jobs)	0.729***	0.730***	0.730***	0.643***	0.643***	0.643***
	(0.003)	(0.003)	(0.003)	(0.008)	(0.008)	(0.008)
Percentage of jobs executed by male	-0.098***	-0.098***	-0.098***	-0.113***	-0.113***	-0.113***
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Constant	0.022***	0.022***	0.022***	0.077***	0.077***	0.077***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	11,782,405	11,782,853	11,782,852	2,524,926	2,524,938	2,524,936
R-squared	0.054	0.054	0.054	0.045	0.045	0.045
Number of lisacode	1,994,702	1,994,711	1,994,711	479,664	479,665	479,665

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B.2 – Robustness analysis with different buffer radii

	M10	M11
Firm specification	Broad	Narrow
Variables	Employment growth	Employment growth
Knowledge location producer amenities	0.003	0.008*
	(0.003)	(0.005)
Knowledge location consumer amenities	0.015**	0.018**
	(0.007)	(0.008)
Located on knowledge location during crisis (2008 – 2011)	-0.024**	-0.050**
	(0.010)	(0.023)
Located on knowledge location during late-crisis (2011 – 2015)	-0.024**	-0.066***
	(0.010)	(0.023)
Firms in size class 2 located on knowledge location	0.122***	0.164***
	(0.016)	(0.021)
Firms in size class 3 located on knowledge location	0.116***	0.153***
	(0.014)	(0.025)
Firms in size class 4 located on knowledge location	0.066***	0.087***
	(0.009)	(0.014)
Firms in size class 5 located on knowledge location	0.048***	0.105***
	(0.011)	(0.026)
Firms in size class 6 located on knowledge location	0.067***	0.053**
	(0.015)	(0.025)
Mining and quarrying	-0.024	
	(0.019)	
Manufacturing	-0.042***	
	(0.015)	
Electricity, gas, steam and air conditioning supply	-0.040	0.001
	(0.050)	(0.059)
Water supply; sewerage, waste management and remediation activities	-0.009	
	(0.024)	
Construction	-0.037	
	(0.023)	
Wholesale and retail trade; repair of motor vehicles and motorcycles	-0.036**	

	(0.017)	
Transportation and storage	-0.054***	
	(0.020)	
Accommodation and food service activities	-0.034	
	(0.026)	
Information and communication	-0.009	0.031
	(0.019)	(0.020)
Financial institutions	-0.071***	-0.033
	(0.025)	(0.023)
Renting, buying and selling of real estate	-0.006	
	(0.030)	
Consultancy, research and other specialized business services	0.004	0.046**
	(0.018)	(0.018)
Renting and leasing of tangible goods and other business support services	-0.013	
	(0.018)	
Public administration, public services and compulsory social security	-0.068*	
	(0.037)	
Education	-0.053**	
	(0.020)	
Human health and social work activities	-0.021	
	(0.023)	
Culture, sports and recreation	-0.023	
	(0.019)	
Other service activities	-0.022	
	(0.032)	
Province of Overijssel	0.023*	-0.125***
	(0.013)	(0.016)
Province of Flevoland	-0.032**	-0.203***
	(0.014)	(0.015)
Province of Gelderland	-0.006	-0.154***
	(0.015)	(0.017)
Province of Noord-Holland	0.010	-0.110***
	(0.015)	(0.016)

Province of Zuid-Holland	-0.002	-0.130***
	(0.014)	(0.016)
Province of Zeeland	-0.009	-0.148***
	(0.015)	(0.014)
Province of Noord-Brabant	-0.010	-0.133***
	(0.017)	(0.017)
Province of Limburg	-0.009	-0.122***
	(0.013)	(0.014)
Percentage of jobs executed by male	-0.002	-0.004
	(0.010)	(0.016)
Constant	0.060***	0.176***
	(0.022)	(0.036)
Observations	17,703	7,867
R-squared	0.024	0.031

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B.3 – Regression models broad & narrow sense firms

	M10a	**M11a**	**M10b**	**M11b**
Firm specification	Broad	Narrow	Broad	Narrow
Buffers	1000m	2000m	1000m	2000m
Variables	Employment growth	Employment growth	Employment growth	Employment growth
Knowledge location innovation drivers (economic asset 1)	-0.010**	-0.014***	-0.004***	-0.006***
	(0.004)	(0.005)	(0.001)	(0.002)
Knowledge location higher education institutions (economic asset 2)	0.005**	0.010***	0.003**	0.001
	(0.002)	(0.003)	(0.001)	(0.002)
Knowledge location innovation cultivators (economic asset 3)	0.004	0.001	-0.001	0.001

	(0.004)	(0.003)	(0.001)	(0.002)
Knowledge location consumer amenities (economic asset 4)	-0.008***	-0.008**	-0.002**	-0.002
	(0.003)	(0.004)	(0.001)	(0.002)
Located on knowledge location during crisis (2008 – 2011)	-0.008	-0.017	-0.006*	-0.016**
	(0.009)	(0.014)	(0.003)	(0.006)
Located on knowledge location during late-crisis (2011 – 2015)	-0.019**	-0.029*	-0.011***	-0.021***
	(0.007)	(0.015)	(0.003)	(0.007)
Firms in size class 2 located on knowledge location	0.107***	0.184***	0.065***	0.127***
	(0.024)	(0.026)	(0.010)	(0.013)
Firms in size class 3 located on knowledge location	0.108***	0.165***	0.073***	0.112***
	(0.019)	(0.029)	(0.008)	(0.012)
Firms in size class 4 located on knowledge location	0.067***	0.096***	0.055***	0.090***
	(0.009)	(0.021)	(0.007)	(0.013)
Firms in size class 5 located on knowledge location	0.021**	0.062***	0.032***	0.063***
	(0.010)	(0.016)	(0.006)	(0.021)
Firms in size class 6 located on knowledge location	0.052***	0.044*	0.042***	0.053**
	(0.017)	(0.024)	(0.009)	(0.019)
Mining and quarrying			0.114	

			(0.165)	
Manufacturing	-0.094***		-0.032	
	(0.013)		(0.019)	
Electricity, gas, steam and air conditioning supply	-0.093	0.034	0.028	0.045
	(0.059)	(0.080)	(0.064)	(0.068)
Water supply; sewerage, waste management and remediation activities	-0.104***		-0.026	
	(0.019)		(0.034)	
Construction	-0.082***		-0.029	
	(0.012)		(0.017)	
Wholesale and retail trade; repair of motor vehicles and motorcycles	-0.098***		-0.032*	
	(0.010)		(0.016)	
Transportation and storage	-0.116***		-0.028*	
	(0.018)		(0.016)	
Accommodation and food service activities	-0.097***		-0.027	
	(0.022)		(0.017)	
Information and communication	-0.078***	0.025	-0.016	0.018**
	(0.011)	(0.024)	(0.015)	(0.008)
Financial institutions	-0.050**	0.053*	-0.040**	-0.015*
	(0.018)	(0.028)	(0.016)	(0.008)
Renting, buying and selling of real estate	-0.077**		-0.027	
	(0.029)		(0.018)	
Consultancy, research and other	-0.063***	0.052**	-0.020	0.019**

specialized business services				
	(0.012)	(0.022)	(0.015)	(0.007)
Renting and leasing of tangible goods and other business support services	-0.079***		-0.017	
	(0.013)		(0.016)	
Public administration, public services and compulsory social security	-0.105***		-0.064***	
	(0.023)		(0.018)	
Education	-0.109***		-0.041**	
	(0.014)		(0.016)	
Human health and social work activities	-0.074***		-0.021	
	(0.013)		(0.017)	
Culture, sports and recreation	-0.080***		-0.032*	
	(0.016)		(0.016)	
Other service activities	-0.086***		-0.030*	
	(0.021)		(0.017)	
Extraterritorial organisations and bodies			-0.122***	
			(0.015)	
Province of Flevoland	0.130***	0.131***	0.058***	0.057***
	(0.023)	(0.025)	(0.005)	(0.010)
Province of Gelderland	0.050***	0.034**	0.025***	0.023**
	(0.016)	(0.016)	(0.004)	(0.009)
Province of Noord-	0.073***	0.080***	0.024***	0.027***

Holland				
	(0.018)	(0.023)	(0.005)	(0.009)
Province of Zuid-Holland	0.111***	0.135***	0.030***	0.038***
	(0.022)	(0.023)	(0.007)	(0.009)
Province of Zeeland	-0.024		0.156***	
	(0.022)		(0.015)	
Province of Noord-Brabant	0.085**	0.100***	0.023***	0.024**
	(0.030)	(0.027)	(0.006)	(0.010)
Province of Limburg	0.038**	0.049**	0.012*	0.017
	(0.016)	(0.022)	(0.007)	(0.018)
Percentage of jobs executed by male	0.006	-0.002	-0.005*	-0.014**
	(0.008)	(0.018)	(0.003)	(0.006)
Constant	0.082***	-0.013	0.051**	0.035**
	(0.023)	(0.039)	(0.020)	(0.015)
Observations	13,053	5,151	63,022	19,672
R-squared	0.028	0.045	0.019	0.034

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B.4 – Robustness analysis with different buffer radii

	M12	**M13**
Firm specification	Broad	Narrow
Variables	Employment growth	Employment growth
Knowledge location physical elements	0.010***	0.0011 **
	(0.004)	(0.005)
Knowledge location image elements	-0.009	-0.015
	(0.007)	(0.009)
Located on knowledge location during crisis (2008 – 2011)	-0.025**	-0.044**
	(0.010)	(0.021)
Located on knowledge location during late-crisis (2011 – 2015)	-0.026***	-0.062***
	(0.008)	(0.018)

Firms in size class 2 located on knowledge location	0.124***	0.171***
	(0.015)	(0.020)
Firms in size class 3 located on knowledge location	0.118***	0.155***
	(0.014)	(0.024)
Firms in size class 4 located on knowledge location	0.069***	0.090***
	(0.008)	(0.013)
Firms in size class 5 located on knowledge location	0.051***	0.105***
	(0.011)	(0.022)
Firms in size class 6 located on knowledge location	0.067***	0.053**
	(0.015)	(0.024)
Mining and quarrying	-0.022	
	(0.019)	
Manufacturing	-0.043***	
	(0.015)	
Electricity, gas, steam and air conditioning supply	-0.047	0.001
	(0.049)	(0.060)
Water supply; sewerage, waste management and remediation activities	-0.011	
	(0.025)	
Construction	-0.036	
	(0.023)	
Wholesale and retail trade; repair of motor vehicles and motorcycles	-0.033*	
	(0.017)	
Transportation and storage	-0.053***	
	(0.019)	
Accommodation and food service activities	-0.038	
	(0.026)	
Information and communication	-0.015	0.029
	(0.018)	(0.020)
Financial institutions	-0.077***	-0.039*
	(0.025)	(0.023)
Renting, buying and selling of real estate	-0.008	
	(0.030)	
Consultancy, research and other specialized business services	-0.000	0.046**

	(0.018)	(0.018)
Renting and leasing of tangible goods and other business support services	-0.016	
	(0.018)	
Public administration, public services and compulsory social security	-0.077**	
	(0.038)	
Education	-0.058***	
	(0.020)	
Human health and social work activities	-0.024	
	(0.023)	
Culture, sports and recreation	-0.028	
	(0.019)	
Other service activities	-0.025	
	(0.032)	
Province of Overijssel	0.034**	-0.107***
	(0.013)	(0.014)
Province of Flevoland	-0.012	-0.183***
	(0.013)	(0.012)
Province of Gelderland	0.000	-0.142***
	(0.014)	(0.016)
Province of Noord-Holland	0.022	-0.084***
	(0.016)	(0.017)
Province of Zuid-Holland	0.014	-0.106***
	(0.016)	(0.017)
Province of Zeeland	0.003	-0.126***
	(0.014)	(0.013)
Province of Noord-Brabant	0.007	-0.117***
	(0.017)	(0.015)
Province of Limburg	0.001	-0.104***
	(0.014)	(0.015)
Percentage of jobs executed by male	-0.001	0.000
	(0.010)	(0.015)
Constant	0.049**	0.148***
	(0.021)	(0.031)

Observations	17,703	8,152
R-squared	0.024	0.031

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B.5 – Regression models broad & narrow sense firms

	M12a	M13a	M12b	M13b
Firm specification	Broad	Narrow	Broad	Narrow
Buffers	1000m	2000m	1000m	2000m
Variables	Employment growth	Employment growth	Employment growth	Employment growth
Knowledge location amenities & resources (physical asset 1)	0.009*	0.009*	0.004**	0.006**
	(0.005)	(0.005)	(0.001)	(0.003)
Knowledge location place & building design (physical asset 2)	-0.007	-0.002	-0.003	-0.002
	(0.005)	(0.005)	(0.002)	(0.002)
Knowledge location connectivity (physical asset 3)	0.001	-0.003	-0.001	-0.003
	(0.004)	(0.003)	(0.001)	(0.002)
Knowledge location image (physical asset 4)	-0.008***	-0.014***	-0.003***	-0.006***
	(0.002)	(0.002)	(0.001)	(0.001)
Located on knowledge location during crisis (2008 – 2011)	-0.008	-0.020	-0.005	-0.016**
	(0.010)	(0.014)	(0.003)	(0.006)
Located on knowledge location during late-crisis (2011 – 2015)	-0.019**	-0.031*	-0.010***	-0.020***
	(0.007)	(0.015)	(0.002)	(0.006)
Firms in size class 2 located on knowledge location	0.108***	0.189***	0.064***	0.127***

	(0.024)	(0.027)	(0.010)	(0.013)
Firms in size class 3 located on knowledge location	0.109***	0.167***	0.072***	0.112***
	(0.019)	(0.028)	(0.008)	(0.012)
Firms in size class 4 located on knowledge location	0.068***	0.097***	0.054***	0.089***
	(0.010)	(0.022)	(0.007)	(0.013)
Firms in size class 5 located on knowledge location	0.023**	0.061***	0.031***	0.062***
	(0.010)	(0.016)	(0.007)	(0.021)
Firms in size class 6 located on knowledge location	0.054***	0.051**	0.042***	0.053**
	(0.017)	(0.024)	(0.009)	(0.019)
Mining and quarrying			0.113	
			(0.164)	
Manufacturing	-0.096***		-0.032	
	(0.014)		(0.019)	
Electricity, gas, steam and air conditioning supply	-0.096	0.028	0.026	0.044
	(0.060)	(0.079)	(0.064)	(0.068)
Water supply; sewerage, waste management and remediation activities	-0.115***		-0.027	
	(0.021)		(0.035)	
Construction	-0.084***		-0.028	
	(0.012)		(0.018)	
Wholesale and retail trade; repair of motor vehicles and motorcycles	-0.100***		-0.032*	
	(0.012)		(0.017)	
Transportation and storage	-0.120***		-0.027	
	(0.019)		(0.016)	
Accommodation and food service activities	-0.099***		-0.026	
	(0.022)		(0.017)	
Information and	-0.079***	0.027	-0.015	0.019**

communication				
	(0.012)	(0.024)	(0.015)	(0.008)
Financial institutions	-0.052**	0.058*	-0.039**	-0.015*
	(0.018)	(0.031)	(0.016)	(0.007)
Renting, buying and selling of real estate	-0.079**		-0.026	
	(0.030)		(0.019)	
Consultancy, research and other specialized business services	-0.063***	0.056**	-0.019	0.019**
	(0.013)	(0.022)	(0.016)	(0.007)
Renting and leasing of tangible goods and other business support services	-0.079***		-0.016	
	(0.014)		(0.016)	
Public administration, public services and compulsory social security	-0.105***		-0.062***	
	(0.023)		(0.018)	
Education	-0.107***		-0.039**	
	(0.014)		(0.016)	
Human health and social work activities	-0.075***		-0.019	
	(0.013)		(0.017)	
Culture, sports and recreation	-0.081***		-0.030*	
	(0.016)		(0.017)	
Other service activities	-0.087***		-0.029	
	(0.021)		(0.017)	
Extraterritorial organisations and bodies			-0.123***	
			(0.015)	
Province of Flevoland	0.072***	0.057***	0.039***	0.028***
	(0.013)	(0.010)	(0.005)	(0.007)

Province of Gelderland	0.019	-0.019	0.012*	-0.000
	(0.020)	(0.015)	(0.006)	(0.006)
Province of Noord-Holland	0.028***	0.028***	0.012***	0.009**
	(0.009)	(0.009)	(0.003)	(0.003)
Province of Zuid-Holland	0.053**	0.061***	0.010	0.005
	(0.021)	(0.014)	(0.007)	(0.009)
Province of Zeeland	-0.052***		0.148***	
	(0.016)		(0.016)	
Province of Noord-Brabant	0.012	0.018*	0.003	-0.004
	(0.009)	(0.010)	(0.003)	(0.005)
Province of Limburg	0.007	0.001	-0.002	-0.003
	(0.017)	(0.012)	(0.006)	(0.015)
Percentage of jobs executed by male	0.005	-0.001	-0.005*	-0.015**
	(0.008)	(0.018)	(0.003)	(0.006)
Constant	0.128***	0.056	0.065***	0.065***
	(0.028)	(0.039)	(0.018)	(0.018)
Observations	13,053	5,185	63,022	19,672
R-squared	0.028	0.045	0.019	0.034

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B.6 – Robustness analysis with different buffer radii

	M14	**M15**
Firm specification	Broad	Narrow
Variables	Employment growth	Employment growth
Knowledge location local networking (networking asset 1)	0.006**	0.008**
	(0.003)	(0.004)
Knowledge location global networking (networking asset 2)	-0.005	-0.000
	(0.004)	(0.005)
Located on knowledge location during crisis (2008 – 2011)	-0.025**	-0.044**
	(0.010)	(0.021)
Located on knowledge location during late-crisis (2011 – 2015)	-0.026***	-0.061***
	(0.009)	(0.018)

Firms in size class 2 located on knowledge location	0.123***	0.170***
	(0.016)	(0.021)
Firms in size class 3 located on knowledge location	0.116***	0.153***
	(0.014)	(0.024)
Firms in size class 4 located on knowledge location	0.067***	0.085***
	(0.009)	(0.013)
Firms in size class 5 located on knowledge location	0.049***	0.099***
	(0.011)	(0.023)
Firms in size class 6 located on knowledge location	0.065***	0.049**
	(0.015)	(0.023)
Mining and quarrying	-0.028	
	(0.020)	
Manufacturing	-0.044***	
	(0.015)	
Electricity, gas, steam and air conditioning supply	-0.049	0.003
	(0.049)	(0.061)
Water supply; sewerage, waste management and remediation activities	-0.013	
	(0.025)	
Construction	-0.035	
	(0.022)	
Wholesale and retail trade; repair of motor vehicles and motorcycles	-0.033*	
	(0.017)	
Transportation and storage	-0.053***	
	(0.019)	
Accommodation and food service activities	-0.036	
	(0.026)	
Information and communication	-0.012	0.036*
	(0.018)	(0.020)
Financial institutions	-0.074***	-0.035
	(0.025)	(0.023)
Renting, buying and selling of real estate	-0.008	
	(0.030)	
Consultancy, research and other specialized business services	0.001	0.050**

	(0.018)	(0.018)
Renting and leasing of tangible goods and other business support services	-0.014	
	(0.018)	
Public administration, public services and compulsory social security	-0.078**	
	(0.037)	
Education	-0.056***	
	(0.020)	
Human health and social work activities	-0.023	
	(0.023)	
Culture, sports and recreation	-0.026	
	(0.019)	
Other service activities	-0.023	
	(0.032)	
Province of Overijssel	0.037***	-0.099***
	(0.014)	(0.016)
Province of Flevoland	0.001	-0.157***
	(0.018)	(0.021)
Province of Gelderland	-0.000	-0.125***
	(0.017)	(0.024)
Province of Noord-Holland	0.020	-0.084***
	(0.014)	(0.019)
Province of Zuid-Holland	0.013	-0.099***
	(0.016)	(0.018)
Province of Zeeland	-0.017	-0.147***
	(0.012)	(0.014)
Province of Noord-Brabant	0.012	-0.098***
	(0.022)	(0.023)
Province of Limburg	0.011	-0.089***
	(0.014)	(0.015)
Percentage of jobs executed by male	-0.002	-0.000
	(0.010)	(0.014)
Constant	0.039	0.077
	(0.042)	(0.058)

Observations	17,703	8,152
R-squared	0.024	0.031

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B.7 – Regression models broad & narrow sense firms

	M14a	M15a	M14b	M15b
Firm specification	Broad	Narrow	Broad	Narrow
Buffer radii	1000m	2000m	1000m	2000m
Variables	Employment growth	Employment growth	Employment growth	Employment growth
Knowledge location local networking	0.005	0.006**	-0.000	0.002
	(0.003)	(0.003)	(0.001)	(0.001)
Knowledge location global networking	-0.008***	-0.010**	-0.002*	-0.005***
	(0.003)	(0.004)	(0.001)	(0.001)
Located on knowledge location during crisis (2008 – 2011)	-0.009	-0.018	-0.005	-0.016***
	(0.009)	(0.013)	(0.003)	(0.005)
Located on knowledge location during late-crisis (2011 – 2015)	-0.021***	-0.030*	-0.011***	-0.020***
	(0.007)	(0.015)	(0.003)	(0.006)
Firms in size class 2 located on knowledge location	0.107***	0.185***	0.064***	0.127***
	(0.024)	(0.026)	(0.010)	(0.013)
Firms in size class 3 located on knowledge location	0.108***	0.165***	0.072***	0.112***
	(0.018)	(0.028)	(0.008)	(0.012)
Firms in size class 4 located on knowledge location	0.067***	0.096***	0.054***	0.090***
	(0.009)	(0.021)	(0.007)	(0.013)
Firms in size class 5 located on knowledge location	0.022**	0.059***	0.032***	0.063***
	(0.010)	(0.016)	(0.007)	(0.021)
Firms in size class 6 located on	0.052***	0.048*	0.042***	0.053**

knowledge location				
	(0.017)	(0.024)	(0.009)	(0.019)
Mining and quarrying			0.114	
			(0.163)	
Manufacturing	-0.106***		-0.033*	
	(0.015)		(0.019)	
Electricity, gas, steam and air conditioning supply	-0.111*	0.023	0.026	0.045
	(0.058)	(0.075)	(0.064)	(0.067)
Water supply; sewerage, waste management and remediation activities	-0.128***		-0.029	
	(0.018)		(0.035)	
Construction	-0.092***		-0.030	
	(0.010)		(0.018)	
Wholesale and retail trade; repair of motor vehicles and motorcycles	-0.107***		-0.033*	
	(0.012)		(0.017)	
Transportation and storage	-0.126***		-0.030*	
	(0.021)		(0.016)	
Accommodation and food service activities	-0.108***		-0.028	
	(0.021)		(0.017)	
Information and communication	-0.085***	0.031	-0.017	0.019**
	(0.012)	(0.025)	(0.015)	(0.008)
Financial institutions	-0.059***	0.062**	-0.040**	-0.014*
	(0.018)	(0.029)	(0.016)	(0.007)
Renting, buying and selling of real estate	-0.087***		-0.028	
	(0.029)		(0.019)	
Consultancy, research and other specialized business services	-0.071***	0.059**	-0.020	0.019**
	(0.012)	(0.022)	(0.016)	(0.007)
Renting and leasing of tangible	-0.088***		-0.018	

goods and other business support services				
	(0.013)		(0.016)	
Public administration, public services and compulsory social security	-0.115***		-0.065***	
	(0.023)		(0.018)	
Education	-0.117***		-0.041**	
	(0.014)		(0.016)	
Human health and social work activities	-0.083***		-0.021	
	(0.013)		(0.017)	
Culture, sports and recreation	-0.089***		-0.032*	
	(0.016)		(0.017)	
Other service activities	-0.094***		-0.030*	
	(0.020)		(0.017)	
Extraterritorial organisations and bodies			-0.121***	
			(0.016)	
Province of Flevoland	0.075***	0.074***	0.040***	0.039***
	(0.008)	(0.009)	(0.003)	(0.005)
Province of Gelderland	0.008	-0.011	0.008	0.005
	(0.013)	(0.020)	(0.006)	(0.006)
Province of Noord-Holland	0.022***	0.028***	0.009***	0.011***
	(0.003)	(0.009)	(0.002)	(0.003)
Province of Zuid-Holland	0.054***	0.078***	0.013***	0.020***
	(0.013)	(0.010)	(0.004)	(0.004)
Province of Zeeland	-0.081***		0.143***	
	(0.011)		(0.017)	
Province of Noord-Brabant	0.021	0.032*	0.002	0.004
	(0.016)	(0.016)	(0.004)	(0.006)
Province of Limburg	0.006	0.014	-0.004	0.006
	(0.011)	(0.011)	(0.005)	(0.019)
Percentage of jobs executed by male	0.005	-0.003	-0.005*	-0.014**
	(0.008)	(0.017)	(0.003)	(0.006)

Constant	0.113***	-0.013	0.054***	0.032*
	(0.025)	(0.044)	(0.017)	(0.016)
Observations	13,053	5,151	63,022	19,672
R-squared	0.028	0.045	0.019	0.034

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B.8 – Robustness analysis with different buffer radii

	M16	**M17**
Firm specification	Broad	Narrow
Variables	Employment growth	Employment growth
Knowledge location producer amenities	-0.000	0.002
	(0.004)	(0.003)
Knowledge location consumer amenities	0.012**	0.018**
	(0.005)	(0.008)
Knowledge location physical elements	0.011**	0.006
	(0.005)	(0.006)
Knowledge location image elements	-0.010	-0.016*
	(0.008)	(0.009)
Knowledge location networking assets	-0.004	0.010
	(0.008)	(0.010)
Located on knowledge location during crisis (2008 – 2011)	-0.026**	-0.044**
	(0.010)	(0.021)
Located on knowledge location during late-crisis (2011 – 2015)	-0.027***	-0.062***
	(0.009)	(0.019)
Firms in size class 2 located on knowledge location	0.124***	0.171***
	(0.016)	(0.020)
Firms in size class 3 located on knowledge location	0.118***	0.155***
	(0.014)	(0.024)
Firms in size class 4 located on knowledge location	0.070***	0.089***
	(0.009)	(0.014)
Firms in size class 5 located on knowledge location	0.052***	0.106***
	(0.011)	(0.022)
Firms in size class 6 located on knowledge location	0.068***	0.053**

	(0.015)	(0.024)
Mining and quarrying	-0.024	
	(0.021)	
Manufacturing	-0.043***	
	(0.015)	
Electricity, gas, steam and air conditioning supply	-0.048	0.006
	(0.050)	(0.064)
Water supply; sewerage, waste management and remediation activities	-0.012	
	(0.025)	
Construction	-0.037	
	(0.023)	
Wholesale and retail trade; repair of motor vehicles and motorcycles	-0.034*	
	(0.017)	
Transportation and storage	-0.053***	
	(0.019)	
Accommodation and food service activities	-0.038	
	(0.026)	
Information and communication	-0.013	0.032
	(0.018)	(0.020)
Financial institutions	-0.075***	-0.038
	(0.026)	(0.023)
Renting, buying and selling of real estate	-0.008	
	(0.030)	
Consultancy, research and other specialized business services	0.000	0.047**
	(0.018)	(0.019)
Renting and leasing of tangible goods and other business support services	-0.015	
	(0.018)	
Public administration, public services and compulsory social security	-0.074*	
	(0.039)	
Education	-0.058***	
	(0.020)	
Human health and social work activities	-0.024	

	(0.023)	
Culture, sports and recreation	-0.027	
	(0.019)	
Other service activities	-0.025	
	(0.033)	
Province of Overijssel	0.028*	-0.102***
	(0.015)	(0.019)
Province of Flevoland	-0.020	-0.181***
	(0.015)	(0.017)
Province of Gelderland	-0.004	-0.122***
	(0.020)	(0.025)
Province of Noord-Holland	0.012	-0.081***
	(0.016)	(0.023)
Province of Zuid-Holland	0.000	-0.106***
	(0.020)	(0.023)
Province of Zeeland	0.003	-0.128***
	(0.015)	(0.013)
Province of Noord-Brabant	-0.003	-0.111***
	(0.020)	(0.022)
Province of Limburg	-0.009	-0.101***
	(0.017)	(0.020)
Percentage of jobs executed by male	-0.002	-0.001
	(0.010)	(0.015)
Constant	0.059***	0.145***
	(0.021)	(0.034)
Observations	17,703	8,152
R-squared	0.025	0.032

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B.9 – Regression models broad & narrow sense firms

	M16a	M16b	M17a	M17b
Firm specification	Broad	Broad	Narrow	Narrow
Variables	Employment growth	Employment growth	Employment growth	Employment growth

Knowledge location with producer amenities	-0.000	-0.006	0.002	-0.002
	(0.004)	(0.004)	(0.003)	(0.003)
Knowledge location with consumer amenities	0.012**	0.009**	0.018**	0.021***
	(0.005)	(0.004)	(0.008)	(0.007)
Knowledge location with physical elements	0.011**	0.020***	0.006	0.013*
	(0.005)	(0.005)	(0.006)	(0.006)
Knowledge location with image elements	-0.010	0.008	-0.016*	-0.004
	(0.008)	(0.010)	(0.009)	(0.011)
Knowledge location with networking assets	-0.004	0.002	0.010	0.013
	(0.008)	(0.007)	(0.010)	(0.008)
Knowledge location with a combination of consumer amenities & physical elements		0.023***		0.016**
		(0.008)		(0.007)
Located on knowledge location during crisis (2008 – 2011)	-0.026**	-0.027**	-0.044**	-0.046**
	(0.010)	(0.010)	(0.021)	(0.021)
Located on knowledge location during late-crisis (2011 – 2015)	-0.027***	-0.029***	-0.062***	-0.065***
	(0.009)	(0.009)	(0.019)	(0.018)
Firms in size class 2 located on knowledge location	0.124***	0.125***	0.171***	0.171***
	(0.016)	(0.016)	(0.020)	(0.020)
Firms in size class 3 located on knowledge location	0.118***	0.119***	0.155***	0.156***
	(0.014)	(0.014)	(0.024)	(0.025)
Firms in size class 4 located on knowledge location	0.070***	0.071***	0.089***	0.091***
	(0.009)	(0.009)	(0.014)	(0.015)

Firms in size class 5 located on knowledge location	0.052***	0.053***	0.106***	0.107***
	(0.011)	(0.011)	(0.022)	(0.022)
Firms in size class 6 located on knowledge location	0.068***	0.070***	0.053**	0.053**
	(0.015)	(0.015)	(0.024)	(0.024)
Mining and quarrying	-0.024	-0.016		
	(0.021)	(0.019)		
Manufacturing	-0.043***	-0.038**		
	(0.015)	(0.015)		
Electricity, gas, steam and air conditioning supply	-0.048	-0.046	0.006	0.004
	(0.050)	(0.052)	(0.064)	(0.065)
Water supply; sewerage, waste management and remediation activities	-0.012	-0.008		
	(0.025)	(0.023)		
Construction	-0.037	-0.032		
	(0.023)	(0.021)		
Wholesale and retail trade; repair of motor vehicles and motorcycles	-0.034*	-0.028*		
	(0.017)	(0.015)		
Transportation and storage	-0.053***	-0.047**		
	(0.019)	(0.018)		
Accommodation and food service activities	-0.038	-0.033		
	(0.026)	(0.025)		
Information and communication	-0.013	-0.009	0.032	0.031
	(0.018)	(0.017)	(0.020)	(0.020)
Financial institutions	-0.075***	-0.068***	-0.038	-0.036
	(0.026)	(0.025)	(0.023)	(0.024)
Renting, buying and selling of real estate	-0.008	-0.002		
	(0.030)	(0.028)		

Consultancy, research and other specialized business services	0.000	0.004	0.047**	0.046**
	(0.018)	(0.017)	(0.019)	(0.019)
Renting and leasing of tangible goods and other business support services	-0.015	-0.011		
	(0.018)	(0.017)		
Public administration, public services and compulsory social security	-0.074*	-0.068*		
	(0.039)	(0.038)		
Education	-0.058***	-0.052***		
	(0.020)	(0.019)		
Human health and social work activities	-0.024	-0.018		
	(0.023)	(0.022)		
Culture, sports and recreation	-0.027	-0.026		
	(0.019)	(0.019)		
Other service activities	-0.025	-0.021		
	(0.033)	(0.031)		
Province of Overijssel	0.028*	0.017	-0.102***	-0.114***
	(0.015)	(0.018)	(0.019)	(0.020)
Province of Flevoland	-0.020	-0.013	-0.181***	-0.176***
	(0.015)	(0.018)	(0.017)	(0.017)
Province of Gelderland	-0.004	-0.027	-0.122***	-0.145***
	(0.020)	(0.022)	(0.025)	(0.028)
Province of Noord-Holland	0.012	-0.004	-0.081***	-0.098***
	(0.016)	(0.019)	(0.023)	(0.023)
Province of Zuid-Holland	0.000	-0.032	-0.106***	-0.134***
	(0.020)	(0.024)	(0.023)	(0.028)
Province of Zeeland	0.003	-0.003	-0.128***	-0.137***
	(0.015)	(0.018)	(0.013)	(0.016)

Province of Noord-Brabant	-0.003	-0.007	-0.111***	-0.117***
	(0.020)	(0.020)	(0.022)	(0.020)
Province of Limburg	-0.009	-0.036	-0.101***	-0.127***
	(0.017)	(0.024)	(0.020)	(0.026)
Percentage of jobs executed by male	-0.002	-0.003	-0.001	-0.002
	(0.010)	(0.010)	(0.015)	(0.015)
Constant	0.059***	0.065**	0.145***	0.160***
	(0.021)	(0.024)	(0.034)	(0.034)
Observations	17,703	17,703	8,152	8,152
R-squared	0.025	0.025	0.032	0.032

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 15 – Regression models broad & narrow sense firms

	M18a	**M18b**	**M19a**	**M19b**
Firm specification	Broad	Narrow	Broad	Narrow
Buffer radii	1000m	2000m	1000m	2000m
Variables	Employment growth	Employment growth	Employment growth	Employment growth
Knowledge location with innovation drivers (economic asset 1)	0.001	-0.016	-0.011**	0.002
	(0.018)	(0.030)	(0.005)	(0.019)
Knowledge location with higher education institutions (economic asset 2)	0.000	0.003	-0.002	-0.002
	(0.005)	(0.007)	(0.001)	(0.003)
Knowledge location with innovation cultivators (economic asset 3)	-0.002	0.002	0.008**	-0.002
	(0.015)	(0.022)	(0.003)	(0.012)
Knowledge location with consumer amenities (economic asset 4)	-0.003	-0.007	-0.019***	0.001

	(0.021)	(0.034)	(0.005)	(0.019)
Knowledge location with amenities & resources (physical asset 1)	0.007	-0.002	0.033***	0.004
	(0.026)	(0.038)	(0.006)	(0.022)
Knowledge location with place & building design (physical asset 2)	-0.013	-0.006	0.005*	-0.007
	(0.013)	(0.017)	(0.003)	(0.010)
Knowledge location with connectivity (physical asset 3)	0.001	0.001	-0.031***	-0.001
	(0.030)	(0.046)	(0.007)	(0.026)
Knowledge location with image (physical asset 4)	-0.005	-0.008	-0.037***	-0.003
	(0.036)	(0.054)	(0.008)	(0.030)
Knowledge location with local networking (networking assets 1)	0.012	0.012	-0.009***	0.008
	(0.014)	(0.017)	(0.003)	(0.010)
Knowledge location with global networking (networking assets 2)	-0.008	-0.000	0.036***	-0.007
	(0.042)	(0.065)	(0.009)	(0.037)
Located on knowledge location during crisis (2008 – 2011)	-0.009	-0.018	-0.006	-0.016**
	(0.010)	(0.014)	(0.003)	(0.006)
Located on knowledge location during late-crisis (2011 – 2015)	-0.020**	-0.030*	-0.011***	-0.020***
	(0.008)	(0.015)	(0.003)	(0.007)
Firms in size class 2 located on knowledge location	0.107***	0.185***	0.065***	0.126***
	(0.024)	(0.026)	(0.010)	(0.013)
Firms in size class 3 located on knowledge location	0.108***	0.166***	0.073***	0.112***
	(0.019)	(0.029)	(0.008)	(0.012)

Firms in size class 4 located on knowledge location	0.067***	0.096***	0.055***	0.089***
	(0.009)	(0.022)	(0.007)	(0.013)
Firms in size class 5 located on knowledge location	0.020*	0.061***	0.032***	0.062***
	(0.010)	(0.017)	(0.007)	(0.022)
Firms in size class 6 located on knowledge location	0.053***	0.048*	0.042***	0.053**
	(0.017)	(0.025)	(0.009)	(0.019)
Mining and quarrying			0.118	
			(0.165)	
Manufacturing	-0.096***		-0.028	
	(0.014)		(0.018)	
Electricity, gas, steam and air conditioning supply	-0.092	0.036	0.029	0.044
	(0.059)	(0.080)	(0.064)	(0.068)
Water supply; sewerage, waste management and remediation activities	-0.107***		-0.025	
	(0.018)		(0.033)	
Construction	-0.082***		-0.026	
	(0.011)		(0.017)	
Wholesale and retail trade; repair of motor vehicles and motorcycles	-0.097***		-0.029*	
	(0.011)		(0.016)	
Transportation and storage	-0.115***		-0.024	
	(0.017)		(0.015)	
Accommodation and food service activities	-0.096***		-0.024	
	(0.022)		(0.017)	
Information and communication	-0.076***	0.030	-0.012	0.021**
	(0.010)	(0.026)	(0.014)	(0.009)
Financial institutions	-0.050***	0.055*	-0.036**	-0.014
	(0.017)	(0.030)	(0.016)	(0.008)

Renting, buying and selling of real estate	-0.078**		-0.024	
	(0.029)		(0.018)	
Consultancy, research and other specialized business services	-0.062***	0.056**	-0.017	0.020**
	(0.012)	(0.023)	(0.015)	(0.008)
Renting and leasing of tangible goods and other business support services	-0.078***		-0.014	
	(0.012)		(0.015)	
Public administration, public services and compulsory social security	-0.105***		-0.060***	
	(0.023)		(0.018)	
Education	-0.108***		-0.038**	
	(0.013)		(0.016)	
Human health and social work activities	-0.074***		-0.017	
	(0.012)		(0.017)	
Culture, sports and recreation	-0.079***		-0.028	
	(0.015)		(0.016)	
Other service activities	-0.085***		-0.027	
	(0.020)		(0.017)	
Extraterritorial organisations and bodies			-0.120***	
			(0.015)	
Province of Flevoland	0.108	0.162	0.079***	0.036
	(0.066)	(0.114)	(0.020)	(0.076)
Province of Gelderland	0.041	0.066	0.030*	0.006
	(0.045)	(0.074)	(0.016)	(0.055)
Province of Noord-Holland	0.058	0.109	0.085***	0.013
	(0.095)	(0.159)	(0.023)	(0.095)
Province of Zuid-Holland	0.090	0.175*	0.032	0.017
	(0.059)	(0.099)	(0.020)	(0.070)
Province of Zeeland	-0.066		0.248***	

	(0.127)		(0.031)	
Province of Noord-Brabant	0.053	0.127	0.088***	-0.001
	(0.113)	(0.192)	(0.029)	(0.118)
Province of Limburg	0.067*	0.107**	0.008	0.024
	(0.035)	(0.046)	(0.012)	(0.037)
Percentage of jobs executed by male	0.006	-0.002	-0.005*	-0.015**
	(0.009)	(0.018)	(0.003)	(0.006)
Constant	0.127	0.048	0.200***	0.073
	(0.149)	(0.233)	(0.036)	(0.123)
Observations	13,053	5,151	63,022	19,672
R-squared	0.029	0.045	0.019	0.034

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B.10 – Robustness analysis with different buffer radii

9.3. B - Survey

Knowledge locations

Dear participant,

Thank you for participating in this survey. The survey is about knowledge locations. A knowledge location can be defined as "geographic areas where (leading-edge) anchor institutions and companies cluster and connect with start-ups, business incubators, and accelerators in an innovative ecosystem". Example of knowledge locations are science parks, knowledge hubs, creative districts, technology parks, open innovation campuses or innovation districts. To create and build a knowledge location I hypothesise that three types of assets are needed, namely economic, physical and networking assets. In this research project, we investigate the effects of these assets on knowledge locations. We aim to find in what way they contribute to 'successful' knowledge locations. The definition of these assets **Economic assets** - are the firms, institutions and organizations that drive, cultivate or support an innovation-rich environment. **Physical assets** - are the public and privately-owned spaces, buildings, open spaces, streets and other infrastructure. They are designed and organized to stimulate new and higher levels of connectivity, collaboration and innovation. **Networking assets** - are the relationships between actors, such as relationships between individuals, firms, and institutions which have the potential to generate, sharpen, and/or accelerate the advancement of ideas. The survey consists of two parts and takes **10 minutes**. We would like to ask you to complete the full survey. If this is not possible, we ask you to complete at least part one (which takes about **2 minutes**). The responses are coded by knowledge location and will be **treated confidentially**. This survey is commissioned by Erasmus University Rotterdam. The research team consists of Prof.dr. Frank van Oort, Drs. J. van Haaren and Jan-Daan Maasland in cooperation with SITE Urban Development. If you have any questions about the survey or if you have other questions, please contact us via the information below. 377534jm@student.eur.nl LinkedIn

Kind regards on behalf of the research team,

Jan-Daan Maasland

Q1 What is your knowledge location?

If you are working on or at multiple locations, please choose the one you are currently working on and/or are most familiar with.

▼ 51 Knowledge locations

Q36 What is the founding year (e.g. 2012) of your knowledge location?

_____

Q18 Part 1

In this part we will ask you about the assets that are present at your knowledge location.
Please indicate on a scale of 1 to 10 the degree to which you feel the assets mentioned are present at your knowledge location. Where 10 means the assets are very abundant and 1 means the assets are not present.

Q13 Economic assets

On this page we will ask you whether economic assets are present at your location. We first ask you about your general impression and subsequently ask about your specific impression. What is your general impression of the presence of economic assets at the knowledge location (such as innovation driving firms, higher education institutions, incubators, knowledge centres and amenities).

Eco Assets Economic assets

	Not present Strongly present 1 2 3 4 5 6 6 7 8 9 10
What is your specific impression of **innovation drivers** (such as creative firms, high-technology firms, software firms, highly specialized firms, the presence of a leading firm, park management)?	
What is your specific impression of **higher education institutions** (such as strong ties with higher education institution, research driven, access to students for jobs, higher education institution-government-industry link (triple helix concept))?	
What is your specific impression of **innovation cultivator** (such as incubators, venture capitalists, institutions that stimulate growth & innovation)?	
What is your specific impression of **consumer amenities** (such as restaurants, coffee places, bars (cafés), hotels, retail shops, good public services)?	

Q15 Physical assets

On this page we will ask you whether physical assets are present at your location. We first ask you about your general impression and subsequently ask about your specific impression. What is your general impression of the presence of physical assets at the knowledge location (such as amenities & resources, place & building design, connectivity and image).

Physical assets Physical assets

	Not present / Strongly present 1 2 3 4 5 6 6 7 8 9 10
What is your specific impression of **amenities & resources** (such as public spaces like parks, plazas and streets. Digital accessible (Wi-Fi) open spaces with the creation of social interaction)?	
What is your specific impression of **place & building design** (such as the level of openness of the knowledge location and the quality of the design)?	
What is your specific impression of **connectivity** (such as the connecting elements, like public transport system, bike paths, sidewalks and public open spaces)?	
What is your specific impression of **image** (such as the attractiveness and reputation of the knowledge location)?	

Q16 Networking assets

On this page we will ask you whether networking assets are present at your location. We first ask you about your general impression and subsequently ask about your specific impression. What is your

general impression of the presence of networking assets at the knowledge location (local and global networking).

Networking assets Networking assets

	Not present / Strongly present 1 2 3 4 5 6 6 7 8 9 10
What is your specific impression of **local networking** (such as stimulating local buzz, meeting spots, shared-working spaces, meetings & events and same cultural traditions & habits of people)?	
What is your specific impression of **global networking** (such as strategic partnerships, creating high level of trust between firms on- and off-side knowledge location, active involvement of firms on the knowledge location with partnerships)?	

Q28 Please indicate whether you want to proceed to part 2 of the survey.

- ○ Yes, save my results for part 1 and continue to part 2 (+- 8 min)
- ○ No, save my results for part 1 and finish the survey

Q35 If you have any questions or concerns regarding this survey or our project, feel free to let us know.

_____

_____

_____

_____

_____

Q31 May we contact you in the future?

Your email address will only be used for communicating our results. The email address will be deleted no later than 6 months after completion of the project.

- ○ No, not at all
- ○ Yes, please send me a link to the report
- ○ Yes, please send me the report and feel free to contact me for more information

Q34 Please fill in your email address below.

_____

Part 2

Economic assets

We will ask you whether different factors of the three assets (economic, physical and networking) are present at your knowledge location.

Q22 Which of the following innovation drivers are present at your knowledge location? (multiple answers are allowed)

- [ ] Creative firms
- [ ] High-technology firms
- [ ] Software firms
- [ ] Leader firms
- [ ] Highly specialized firms (for example small furniture firms, or small application developers)
- [ ] Park or location management organization
- [ ] A diverse set of firms
- [ ] An entrepreneurial climate
- [ ] None of the above

Q25 Which of the following higher education institutions (university / hogeschool) are present at your knowledge location? (multiple answers are allowed)

- [ ] Strong ties higher education institutions
- [ ] Research driven higher education institutions
- [ ] Access to students to fill vacancies or provide knowledge
- [ ] Collaboration in a Triple-helix concept (cooperation of Higher Education Institutions, Industry and Government)
- [ ] None of the above

Q26 Which of the following innovation cultivators are present at your knowledge location? (multiple answers are allowed)

- ☐ Active incubators, such as organizations that focus on start -ups to let them growth, open to every firm)
- ☐ Active accelerators, such as organizations that stimulate growth of scale-ups or other firms, more specialized in certain sector
- ☐ Other institutions and organizations that stimulate growth & innovation
- ☐ None of the above

Q27 Which of the following consumer amenities are present at your knowledge location? (multiple answers are allowed)

- ☐ Restaurants
- ☐ Coffee places
- ☐ Bars (cafés)
- ☐ Hotels
- ☐ Retail shops
- ☐ Good public services
- ☐ None of the above
- ☐

Physical assets

Q29 Which of the following amenities & resources are present at your knowledge location? (multiple answers are allowed)

- ☐ Flexible facilities
- ☐ Access to various amenities/functions
- ☐ Public and semi-public meeting and working spots
- ☐ Mixed-use buildings (living and working)
- ☐ Exhibition space, showrooms
- ☐ Shared facilities (to work)
- ☐ Venues for training & education, cultural events & entertainment
- ☐ Small parks & plazas
- ☐ Mixed-income housing
- ☐ Neighbourhood-serving retail, such as local shops
- ☐ Affordable space for start-ups
- ☐ Digital-accessibility (Wi-Fi)
- ☐ None of the above

Q30 Which of the following place & building design are present at your knowledge location? (multiple answers are allowed)

- ☐ Design of built environment in terms of being invited and welcomed into the knowledge location (e.g. transparent and light materials)
- ☐ Modularity, standardization and openness of buildings
- ☐ None of the above
- ☐

Q30 Which of the following connectivity are present at your knowledge location? (multiple answers are allowed)

- [ ] Diversity of infrastructure
- [ ] Pedestrian oriented infrastructure
- [ ] Public transportation (close by or connected with the knowledge location)
- [ ] Physical connectors, such as (public) spaces are forming connectors in the infrastructure
- [ ] Connecting location with broader area
- [ ] None of the above

Q31 Which of the following image are present at your knowledge location? (multiple answers are allowed)

- [ ] Uniqueness of identity, such as mental mapping, memorizing buildings and objects
- [ ] Quality of place (attractiveness)
- [ ] Reputation (media coverage)
- [ ] None of the above

Networking assets

Q34 Which of the following local networking factors are present at your knowledge location? (multiple answers are allowed)

- ☐ Stimulating local buzz of the knowledge location, such as shared lunches, other social events
- ☐ Meeting spots
- ☐ Shared-working spaces
- ☐ Meetings & events
- ☐ Same cultural traditions & habits of people
- ☐ None of the above
- ☐

Q35 Which of the following global networking factors are present at your knowledge location? (multiple answers are allowed)

- ☐ Strategic partnerships
- ☐ Creating high level of trust between firms on and outside the knowledge location
- ☐ Active involvement of firms in the knowledge location with partnerships
- ☐ None of the above