THE INNOVATION HUB

- A knowledge-based view on industry clustering

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ABSTRACT

This thesis argues for theory on industry clustering to embrace the potential for cooperation and innovation within a cluster. It also provides a proposition for the important factors driving that transition towards becoming a place of cooperative knowledge sharing and a hub of innovation.

Drawing on a variety of scientific literature and a literature review of established theory on strategy, knowledge, and innovation, the argument is made that an industry cluster excels as facilitator of knowledge-sharing and innovation through cooperative activities. The main reason being the commonalities gathering an industry in such a concentrated space provides and how that along with frequent interactions helps relationship building and knowledge-sharing to happen more efficiently.

Observations from the world's most innovative cluster, Silicon Valley, proves that cooperation can take place between companies and the support environment around the cluster, in the form of institutions, government, universities, among others, as well as between competing companies in a way that is mutually beneficial. The value and innovation created by these cooperative activities is made possible and enhanced by the clustered environment.

Bringing together the theoretical perspective and the learnings from Silicon Valley, it is proposed that what drives the transition from industry cluster to innovation hub is establishing trust, creating and retaining talent, motivating knowledge sharing, and opening innovation processes. Sustaining the innovation hub requires integrating a supportive institutional network, establishing commonalities, and having united cultural leaders.

Table of Contents

1. INTRODUCTION

A geographic location where companies and institutions within a particular field interconnect is what we know as an 'industry cluster'. It is based on the theory of Michael Porter, who first introduced this concept in 1990, but truly developed it in his 1998 paper "Clusters and the New Economics of Competition".

Clustering of industries is in itself a paradox in the modern world as distances become smaller and smaller with the further development of technology and logistics. Porter (1998, p. 77) admits this irony stating that "In theory, more open global markets and faster transportation and communication should diminish the role of location in competition.". The competitive advantage gained from proximity should be nullified when most things can be sourced through the global market and networks (Porter, 1998).

If the significance of location is an outdated source of gaining competitive advantages, then why do we observe clustering of industries? Many industries show signs of clustering like the movie industry in Hollywood, the financial industry in Wall Street, the medicinal industry in Denmark, manufacturing and trade has agglomerated in the Chinese city of Guangzhou, and of course the tech industry in Silicon Valley, California.

The business world map is full of these clusters of industries where all parts of the economic ecosystem gather in close proximity, especially in the wealthier and more advanced nations (Porter, 1998). The concentration of industries in a specific area has mainly been credited to the economies of scale gained from being part of an agglomeration of organizations related by industry. Many factors of industry clustering provide firms with efficiency advantages compared to distant rivals, but advantages of clustering could theoretically go far beyond just economies of scale and efficiency.

In the Californian tech cluster Silicon Valley, we observe something that differs from what traditional cluster theory emphasizes. In Silicon Valley, the true value seems to have its root in the cooperative nature of the industry cluster. The area and industries clustered there have sprawled in recent years providing value and growth to a large percentage of participating firms. Today, the tech cluster is an epicenter of innovation and the birthplace of some of the most valuable companies in the world.

This thesis will elaborate on existing cluster theory with focus on the potential of cooperative activities for an industry in a clustered environment. Analyzing the advantages that come from cooperation between competitors and which factors that drive this sort of cooperation will be the focus of this paper. Understanding why an industry cluster might be the perfect facilitator for partnerships, cooperation and mutual innovation could lead to an argument that changes the theoretical basis for why industries should cluster, and companies should locate amongst each other.

1.1 Problem Statement

In the theoretical view of Porter's cluster theory, a company should locate in a cluster to match the competitive advantages competitors gain from being there. However, clusters are not only observed as a gathering of businesses seeking to match their competitors. They are also often observed as facilitators of innovation and cooperation. Industry innovation can often be traced back to clusters such as with tech in Silicon Valley. These hubs of innovation share many characteristics with the industry clusters defined by Porter but cannot be fully explained by the established theory.

A clustered industry interacts with many other factors that play a part in determining the state and performance of the cluster. In Silicon Valley, many of these other factors are integrated as a cooperative partner, supporting and enhancing the innovative capabilities of the cluster. If an innovation hub is an evolution of the industry cluster and can be considered as a step forward, then to which degree are we able to define the conditions necessary to facilitate this transition?

1.2 Research Question

The following research question and support questions will act as guideline for the thesis and which areas it will cover.

How can theory on industry clustering benefit from embracing the cluster as a facilitator of cooperative knowledge sharing and innovation, and what drives the transition towards becoming a hub of innovation?

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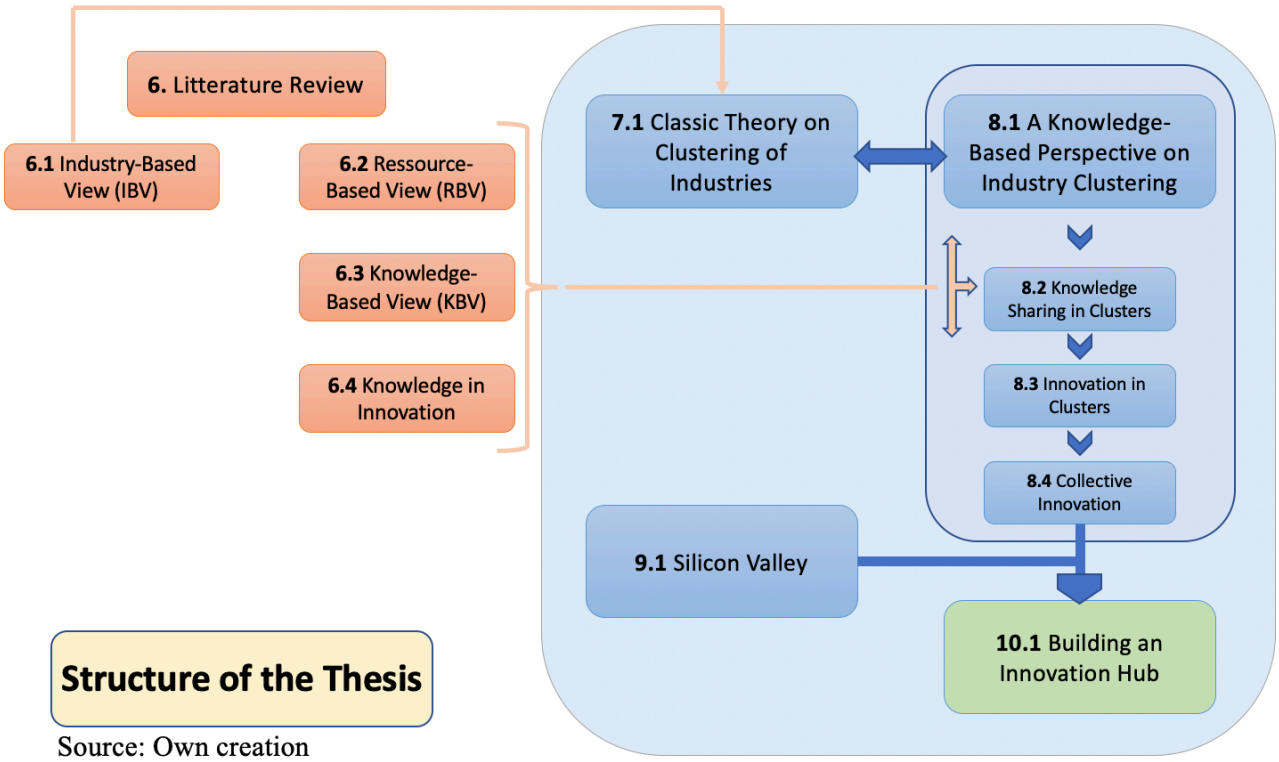
1. *How does the classic theory by Porter (1998) explain clustering of industries?*
2. *How can a knowledge-based view add to the theoretical understanding of industry clustering and how does that change the potential for cooperation and innovation in clusters?*
3. *What does the world's most successful cluster Silicon Valley teach us about how to empirically set up an environment of cooperation and innovation?*

1.3 STRUCTURE

The analysis will begin with an explanation of classic theory on industry clusters, drawing on concepts from the literature review of the IBV. Then a knowledge-based view on the topic will be compared to the classic theory in a discussion that seeks to add perspective to the theory. That knowledge-based perspective will be used as basis for analyzing the potential of knowledge sharing, cooperation, and innovation in a clustered environment, drawing on the theoretical foundation presented in the literature review of the RBV, the KBV, and the role of knowledge in innovation.

The analysis will form a theoretical idea of collective innovation in an industry cluster and then draw on inspiration from Silicon Valley as a real-life example of this to define the concept of an innovation hub. Finally, a discussion will combine this information and try to isolate the key pillars on which an innovation hub is established, and which drivers enable the sustainability of that innovation hub.



Source: Own creation

2. DELIMITATION

Theory on industry clustering has its roots in Porter's 1990 book "The Competitive Advantage of Nations". It is further elaborated in his 1998 paper "Clusters and the New Economics of Competition" which is the text this thesis will consider as classic theory on industry clustering. The theory is more than 20 years old now and therefore it seems relevant for this thesis to challenge it using a modern example of an industry cluster as inspiration.

The literature review does not contain cluster-specific theory because that is a key part of the subsequent analysis. The theoretical concepts chosen for the literature represents the foundational theory that the analysis will draw on and are presented in the order they become relevant for the analysis.

The thesis will not go deeply into the different aspects of how competition works in cooperative clusters or innovation hubs, but rather focus on the potential of cooperation. The type of cooperation discussed is mostly between competitors or with the supportive system around the cluster, because cooperation along the supply chain is covered extensively by classic cluster theory.

This thesis focuses on industries that act on a global market, and it is created from the perspective of companies. The thesis will keep a 'bird's eye' view and not concentrate on specific companies or partnerships.

The thesis is not meant as a solution or answer to an issue, but instead as a presentation of an aspect that should be integrated as a more important concept in theory on industry clustering. The arguments and conclusion made by this thesis are inspired by Silicon Valley, limiting its validity as a direct blueprint for all industries to follow.

The point is not to create a foolproof solution that solves a problem, but instead to expand the horizon of the specific theoretical field. While it does paint an idealistic picture, argumentations are based on peer-reviewed scientific research, and therefore warrant for future research on industry clustering to consider this as a field of study.

3. METHODOLOGY

This thesis will follow the structure of a scientific research paper based on literature. It seeks to challenge an established theoretical standpoint and makes use of a real-world case example to support the argumentation. An empirical element in this thesis will be observations about Silicon Valley's inner workings and how it has sprawled and evolved to illustrate a 'proof of concept' for the arguments made. The case of Silicon Valley

does not on its own provide theoretical basis for the arguments, but it does provide perspective for the discussion.

Philosophy of Science

The philosophy of this thesis can best be described as a hermeneutic approach where presumptions affect the process (Boell, 2014). The collection of empirical data was influenced by the overall vision of establishing a theory that could explain why cooperation and innovation improve a cluster's performance, which means that the literature search could not be completely objective. The hermeneutic circle describes the process through which the arguments made by this thesis were created (Boell, 2014). The data collection was approached with an idea of what would be relevant. Then collected data was consumed, interpreted, and used to create a new idea of what would be relevant to investigate as part of the thesis. Approaching the thesis from this perspective means that the conclusion and arguments presented are influenced by the presumptions and interpretation of the person making them.

Analytical Approach

This thesis takes an inductive approach in the sense that observing Silicon Valley as an industry cluster beyond what traditional theory on the subject could explain, created the motivation to establish a theoretical hypothesis that could. The goal is to question the classic theory on the subject and shine a light on the gap illustrated by the Silicon Valley cluster, by collecting input from different areas of literature. It is not an attempted falsification of established theory as this thesis does not reject but instead seeks to add perspective to the theory.

Scope of the Thesis

The scope of this thesis revolves around established theory on clustering of industries which is but a small part of the overall field of business strategy. The scope is far from narrow though as clustering of industries is a worldwide phenomenon and this thesis will focus on clusters of industries that act on the global market. Given this broad scope, the primary empirical data will be existing literature in the form of scientific papers. Not having to spend resources on creating own primary data provides an opportunity to cover a wider range of theory across the specific field of study.

Since this thesis challenges a broadly established theoretical view, it was determined that spending resources and pages on empirical data collection would not add substance. Doing local data collection in the form of interviews, questionnaires or something else within my realm of possibility in terms of accessibility, could not in my opinion serve as a strong enough foundation for making the arguments presented in this thesis. It would be more of a sidestep than a step forward towards a relevant and thoroughly analyzed conclusion.

Data Collection and Data Quality

The conclusions in this thesis is primarily based on qualitative data, which makes the process of searching through literature with a critical eye an important part of writing this thesis, being increasingly aware of the source, while critically evaluating statements and the foundation they are based upon.

The general approach has been to rely on peer-reviewed work published in scientific journals or books published by acknowledged experts for theoretical argumentation, while being more lenient when using sources for more descriptive purposes. This choice also allows for the buildup of stronger arguments and more nuanced discussions. Relying on research drawn from experts in different fields and with different views on the subjects discussed helps to provide a substantial argument in this case.

4. Literature Review

In the literature review of this thesis, the theoretical foundation on which the analysis is built will be presented. Only broad concepts are introduced in the literature review as they are elaborated on and used in the context of industry clustering later in the thesis. These key concepts will be explained in the order they appear relevant for the analysis. The industry-based and resource-based view on strategy are initially explained, leading to an explanation of the knowledge-based view on strategy and an elaboration of knowledge as a resource. Finally, theory on the role of knowledge in innovation and the concept of open innovation is presented.

4.1 The Industry-based View

The industry-based view (IBV) on business strategy focuses on competitive advantages from positioning in relation to the industry. The industry environment contains several factors such as competitors, suppliers, customers, politics and such which a company needs to analyze and understand as part of their strategic process (Grant, 2016). There is a large focus on predicting the external environment and especially trends in competition to understand when and where resources should be invested (Grant, 2016).

The front man of the IBV is Michael Porter and he has created a framework for analyzing the state of the industry and its competitive environment. Porter's Five Forces (1979) is a model for evaluating the different players in an industry and is used to determine where the power lies and where threats potentially could be. It is an analysis of the forces that shape the competitive scene of the industry (Porter, 1979). The goal is to determine how a company should position itself within that industry and strategize to best adapt to the shape and competition of the industry (Porter, 2008). The five different competitive forces of an industry are:

Source: Porter, M. E. (2008). The five competitive forces that shape strategy. *Harvard Business Review*, *86*(1), 79-93+137.

- Competitors

  Traditional competition in an industry includes price discounting, product introduction, advertising campaigns, and service improvements (Porter, 2008). Simply put, high degree of rivalry limits the profitability of the industry, because competing on price transfers industry value towards the four other industry forces (Porter, 2008). The intensity of rivalry is increased by factors such as the high number of competitors, slow growth of the industry, low innovation, and high fixed costs (Porter, 2008).

- Suppliers

  If the suppliers are able to charge higher prices, they will capture a lot of the industries value for themselves (Porter, 2008). The power of suppliers increases when they as a group are more concentrated than the industry, meaning that not many alternatives exist (Porter, 2008). The power of suppliers increases if the suppliers are not solely dependent on one industry, because they serve several industries or if it is costly to switch between suppliers (Porter, 2008).

- Buyers

  If customers are powerful, they capture industry value by forcing prices down or demanding better quality and service, which increases costs and competition for the industry companies (Porter, 2008).

Buyers become increasingly powerful the more price-sensitive they are, meaning that price change leads to a significant change in demand (Porter, 2008).

- New entrants

  New companies entering the industry means more participants in the fight for market share, but also the threat of diversification that will shift the competitive balance (Porter, 2008). When the threat of new entrants is high, it puts a ceiling on the profitability as companies must keep prices low and investments high to deter potential newcomers from entering (Porter, 2008). The threat of entrants is low when the barriers of entry is high (Porter, 2008). Barriers of entry include economies of scale because bigger companies benefit from large-scale operations, high customers costs of switching between products, significant capital requirements, and more (Porter, 2008).

- Substitutes

  A substitute is a product that performs in a similar function as the product of the industry does but is not the same (Porter, 2008). If the presence of substitutes is high, it limits the profitability potential of the industry as it puts a cap on the marketable price point (Porter, 2008). An industry should seek to distance itself from substitutes as it often hurts the growth potential of the industry (Porter, 2008).

Additionally, Porter and the IBV considers government and complementarities as industry shaping forces. The governmental force is significant because policies and regulations strongly affect the inner workings of an industry and its potential either positively or negatively (Porter, 2008). Complementarities is the force representing products and services that complement what is provided by the industry. If the market for complementarities is strong it helps the industry create customer benefits as products combined value is greater than the sum of each product on its own (Porter, 2008).

Critics of the IBV claims that doing analysis on an industry-level should never be used to create strategy on a firm-level and therefore solely relying on positioning your company in relation to the external environment may not be beneficial, because other firms can do the same and maybe do it better (Grant, 2016). The main criticism is that the IBV does not offer solutions to issues in the external environment and does not consider the strength and weaknesses of the individual company (Grant, 2016).

4.2 THE RESOURCE-BASED VIEW

Opposed to the industry-based view (IBV), which revolves around the importance of positioning the firm in the most advantageous way in relation to its external environment and the shape of the industry, the resource-

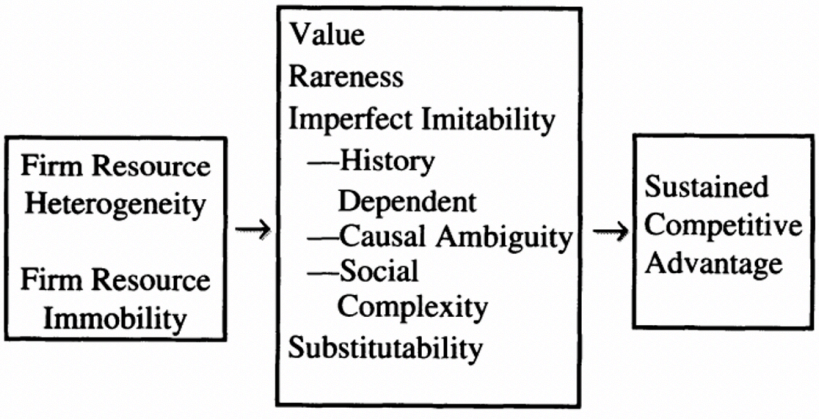
based view (RBV) considers the internal environment of the firm as the core of strategy. From an RBV perspective, business strategy should be planned and carried out based on a firm's internal resources and capabilities as they represent the firm's strengths and weaknesses and therefore also determine what the firm is most likely to succeed in doing.

IBV talks about achieving competitive advantages from strong positioning within the industry and the right competitive strategy based on the activities of the company's most apparent competitors. RBV evolves this concept by considering how a firm can, not just achieve a competitive advantage, but how they can sustain that advantage, keeping them ahead of the competition and achieving growth.

RBV is built on the main principle that firms are heterogeneous and possess unique resources and distinctive capabilities, allowing them to make use of resources in ways that differ from other firms (Barney, 1991). In RBV perspective, a firm's resources and capabilities are significant determinants in their ability to generate value (Amit & Schoemaker, 1993). Overall, RBV concludes that the collection of unique resources and capabilities inside a firm is a highly influential factor in its evolution and growth (Barney, 1991).

As one of the most prevalent voices of the RBV, Barney (1991) presents a more in-depth way to evaluate a firm's internal resources. According to him, these resources can be either physical, human, or organizational in their nature as internal capital (Barney, 1991). Barney (1991) establishes the four conditions that a resource or capability must fulfill in order to be classified as a source of sustainable competitive advantage:

1. Valuable – It has to enable the firm to improve its efficiency and effectiveness.
2. Rare – It cannot be possessed by several other competing firms.
3. Imperfectly imitable – Firms that do not possess it should not be able to obtain it.
4. Non-substitutable – No equally valuable and strategically equivalent substitute that is more obtainable can exist.



Source: Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, *17*(1), 99–120. (p. 112)

The model developed by Barney was later refined and the fourth condition is now to evaluate if the organization is set up to exploit the resource or capability and get full value out of it (Barney, 1997). The VRIO model is used to evaluate the strength of a competitive advantage based on the four factors *value, rare, imitability, and organization*. The below model is created by Barney himself and explains this visually (Barney & Hesterly, 2012).

Valuable?	Rare?	Costly to imitate?	Exploited by the organization?	Competitive implication
No				Competitive disadvantage
Yes	No			Competitive parity
Yes	Yes	No		Temporary competitive advantage
Yes	Yes	Yes	No	Unexploited competitive advantage
Yes	Yes	Yes	Yes	Sustained competitive advantage

Source: Barney, Jay B, & Hesterly, William S. (2012). *Strategic management and competitive advantage: Concepts* (4. ed., International ed.). Upper Saddle River, N.J: Pearson Education.

The intangible resources that relates to human capital and organizational capital are mostly what provides a firm with a sustainable competitive advantage (Amit & Schoemaker, 1993). Human resources and capabilities have a degree of mobility potential and therefore Hitt *et al.* (2001) argues that the true source of sustained competitive advantage is capabilities that are complementary to the human capital which allow an organization to integrate and make better use of it than other organizations.

4.3 The Knowledge-based View

The knowledge-based view (KBV) on organizations and business strategy builds upon the ideas presented by the resource-based view (Grant, 1996). KBV argues that the most important resource a firm can possess is knowledge and that the most valuable capabilities revolves around a firm's ability to use and gain value from knowledge (Grant, 1996). The KBV, like the RBV, considers firms as heterogeneous and that competitive advantages come from possessing unique resources.

4.3.1 Knowledge as a Resource

KBV does not consider knowledge as a resource stored in the organization and held in stock by the company as other resources might be, but rather that knowledge as a resource is maintained by and embodied in

individuals (Grant, 1996). In this way, the KBV views organizations as a collection of knowledge and the intangible resource of knowledge as the key in providing sustainable competitive advantages (Wiklund & Shepherd, 2003). Since firms are heterogeneous, their knowledge resources will differ from other firms in their characteristics, and from that uniqueness advantages can be created (Rouse & Daellenbach, 2002). That is the foundation of the knowledge-based view.

The KBV largely considers two different types of knowledge: *explicit* and *tacit*. The two types are different but not separate, often interact on a continuum (Nonaka & von Krogh, 2009). Activities or actions are often a mix of both. Explicit knowledge is the more formalized form of knowledge that can be documented and shared systematically. Explicit knowledge can be formulated in sentences or captured in drawings and writing. It is universal in its nature, meaning that it can be accessed by most and transferred between individuals without major obstacles (Nonaka & von Krogh, 2009).

Tacit knowledge is created through actions and experience. It exists on a more subconscious level in individuals, making it more difficult to share. Tacit knowledge is tied to experience, intuition, implicit rules of thumb, and such held cognitively inside the mind of individuals and not easily accessed by or transferred to other individuals (Nonaka & von Krogh, 2009). In KBV literature, tacit knowledge is considered the most valuable of the two, being the source of innovation and capabilities that provides competitive advantages that are more immobile and difficult to imitate.

4.3.2 TACIT KNOWLEDGE

The concept of tacit knowledge originates from the 1958 book *Personal Knowledge* by Michael Polanyi and largely resembles the meaning of the more modern word 'know-how' (Gertler, 2003). It is knowledge that exists cognitively in the mind of the person who has built it up through experience. It is described as cognitive because the person may not even be aware that they possess that exact knowledge or how it may influence their behavior. Tacit knowledge is intuition and even if aware of its existence, explaining it or trying to transfer it to someone else through communication will never fully capture it (Nonaka, 1994). Polanyi argues that "tacit knowledge must be learned by demonstration, imitation, performance, and shared experience." (Gertler, 2003, p. 89).

If the interacting parties share similarities, be it language, code of behavior, culture, or knowledge about each other's history of collaborative behavior, then in addition to enhancing the effectiveness of knowledge sharing, it also helps to build trust between them, which is vital to cooperation. Similarities lead to trust, and trust leads to better knowledge sharing (Gertler, 2003).

Mentoring is broadly recognized as the best way of transferring tacit knowledge, since it allows for the other party to observe and interact with the holder of the knowledge in situation where it is used (Grant, 2016).

Sharing tacit knowledge is never perfect and there is a cost in the sense that the knowledge is incomplete when it reaches the receivers cognition (Grant, 2016). That cost depends on the geographical distance between the parties as it is tied strongly to context and action (Grant, 2016). The idea that tacit knowledge is not easily shared across distances is well established in literature by now. It requires face-to-face interactions between parties that already have a lot in common (Nonaka & von Krogh, 2009). Being physically present allows for observation, imitation, correction, and repetition, all of which helps the transmission of tacit knowledge be more complete (Grant, 2016).

4.4 The Role of Knowledge in Innovation

Sharing tacit knowledge is valuable because it creates new tacit knowledge which leads to innovation (Nonaka & von Krogh, 2009). "Newly acquired individual knowledge enables improved or new definitions for problems and solutions and more effective task performance." (Nonaka & von Krogh, 2009, p. 646). For organizations or groups, shared tacit knowledge improves group decision making and problem-solving because it allows for shared insights, expertise, and capabilities (Grant, 1996).

Innovation in its purest form is ultimately a process that blends research with knowledge to create something new (Grant, 2016). That new thing can be a product or even an improvement on an existing product. It can be a new process of making a product that adds value by decreasing production time or costs. It can be a process that reduces consumption or waste, or something that increases flexibility or quality. Innovation can also be new ways of marketing products or even new ways of structuring the internal organization or business model. Innovation can take many forms, but is always novel in its nature (Grant, 2016).

Innovation is most valuable when it changes the 'rules of the game', like disruptive innovation or blue ocean strategy. Disruption is often done by smaller firms in an industry when a paradigm shift is forced by the introduction of something completely new that changes customer demand and the competitive state of the industry (Christensen & Bower, 1996). Innovation can also create completely new markets if the concept is differentiated enough from what is current. This so-called 'blue ocean' strategy is the concept of leaving an intensely competitive market through innovation that allows for the creation of a new market full of potential and value to capture (Kim & Mauborgne, 2005).

In the process of learning through interaction, knowledge does not flow unilaterally from producer to user. As the user often seeks innovative solutions to a problem, they will share tacit knowledge with the producer that in turn will use this combined with their own tacit knowledge to create new tacit knowledge for both parties (Hargadon & Sutton, 2000). That new knowledge could not have been created in isolation, old knowledge had to serve as the raw material used to create the new ideas. Hargadon & Sutton (2000) refer to it as 'knowledge

brokering' when firms innovate by putting old knowledge in front of fresh eyes, using their different perspective to spot how old ideas can be used in new ways. It requires these two parties coming together in collaboration, and that is the reason why a lot of recent literature now considers innovation to be a social process (Gertler, 2003).

4.4.1 THE KNOWLEDGE-BROKERING CYCLE

Hargadon & Sutton (2000) introduces a theory on innovation that builds on their concept of knowledge brokering and the idea that innovation is a social process. Hargadon & Sutton (2000) describes the innovation process as a 'knowledge-brokering cycle' where companies systematically innovate by understanding how to utilize knowledge as a resource and driver of innovation. Those that perform best are the organizations that excel in exchanging and brokering knowledge in way that benefits their own capabilities to innovate. Organizations that succeed in encapsulating the four steps of the innovation cycle transcends into what Hargadon & Sutton (2000) calls 'Innovation Factories' harnessing great value from a continuous flow of ideas. Hargadon & Sutton (2000) presents the four steps of the 'knowledge-brokering cycle' as follows:

1. Capturing Good Ideas

   The prime thing for any company wanting to be a great innovator is the ability to bring in promising ideas. This part of being a great innovator relates to an organizations ability to recognize that "old ideas are their main source of new ideas – even when they are not sure how an old idea might help in the future." (Hargadon & Sutton, 2000). Ideas should not just be thrown away if they are not obviously valuable or have clear potential. The ideas innovation sprawl from can come from anywhere and old ideas are useful because they provide information on what is good and what is bad, but also serves as an inspirational starting point for new thinking (Hargadon & Sutton, 2000). All in all, the first step to becoming an 'innovation factory' is to collect as many ideas as possible. "Some will lead to innovations, some will not. The important thing is that they are there." (Hargadon & Sutton, 2000, p. 160).

2. Keeping Ideas Alive

   Building up a large pile of ideas is one thing, keeping them alive is another and it is as crucial a capability, because "ideas can't be used if they are forgotten." (Hargadon & Sutton, 2000, p. 160). Having the needed information at hand whenever it is relevant is important for efficient problem-solving, but it can be difficult to maintain the availability of organizational knowledge. The internal knowledge pool is never set in stone; when people leave so does knowledge and often this knowledge has not fully spread to others within the organization.

   Sharing tacit knowledge is the key to innovation and idea creation (Gertler, 2003), which means that any organization with the ambition of becoming an 'innovation factory' should strive to capture as

much of it as possible. Hargadon & Sutton (2000) proposes that internally spreading information about who knows what is a powerful tool for organizations to mitigate the issue of tacit knowledge being intangible and difficult to share. If an organization succeeds in establishing this information, then it is more likely that the right people will be part of solving the problems their knowledge is needed for (Hargadon & Sutton, 2000). Knowing who knows what also helps paring up those who have tacit knowledge with the ones that are building new tacit knowledge, emphasizing interaction and mentorship (Gertler, 2003).

3. Imagining New Uses for Old Ideas

   The third step of the innovation cycle happens after ideas have been captured and kept alive. These ideas are then available for new thinking and imagination as to how it can be used in new ways. Hargadon & Sutton (2000) has found that a less obvious but highly important factor in an organization's innovation output is the openness of the physical office building. In other words, they found that the so-called 'innovation factories' all shared the fact that frequent interactions between individuals was encouraged and, in many cases, even forced. "Companywide gatherings, formal brainstorming sessions, and informal hallway conversations are just some of the venues where people share their problems." (Hargadon & Sutton, 2000, p. 162). The less walled-in issues are, the more ideas and knowledge can be involved in finding the solutions. A company should seek to have a high degree of openness related to their issues, because knowledge is spread throughout the organization stored within individuals and therefore ideas can come from many places (Hargadon & Sutton, 2000).

4. Putting Promising Concepts to the Test

   For an idea to actually amount to anything valuable, it has to be transformed into something that can be tested and then, if successful, be implemented and integrated into the organizations business activities. This final step in becoming an 'innovation factory' relates to an organizations ability to quickly turn ideas into something real and usable (Hargadon & Sutton, 2000). Making ideas testable as early in the innovation process as possible, means that mistakes can be caught and improved too a much higher degree than if ideas remain intangible all through the refining process and only then, when the idea is fully developed, gets turned into something real and implemented (Hargadon & Sutton, 2000).

   Ideas must be considered as "inexpensive and easily replaceable playthings" (Hargadon & Sutton, 2000, p. 163), rather than as anyone's property or possession that they are held accountable for or themselves have a special interest in. Innovation is most successful when focus is on finding the best solutions to the problem, not the solution that earns you most praise (Hargadon & Sutton, 2000).

Hargadon & Sutton (2000) argues that organizations should be reaching out to anyone who can add value to the idea creation and testing process as early and often as possible. Automatically rejecting ideas from outside the organization or ignoring the potential that exists outside the organizational boundaries can be fatal to innovation (Hargadon & Sutton, 2000). Organizations should not worry about failing in this process, as failure and understanding why an idea failed can provide useful experience and knowledge for future problem-solving. Failure, in itself, represents old ideas that should be captured for developing new ideas and so the 'knowledge-brokering cycle' continues (Hargadon & Sutton, 2000).

4.4.2 Open Innovation

Recently, and especially since Chesbrough (2003), researchers have begun differentiating between open and closed innovation (Huizingh, 2011). Closed innovation is where companies generate their own ideas and then develop, market, finance, and support them with their own resources internally (Chesbrough, 2003). Almost no companies use a fully closed innovation strategy as many social and economic factors in modern times have made it necessary to open innovation processes up (Huizingh, 2011). Factors such as: "changes in working patterns, increased labor division due to globalization, improved market institutions for trading ideas, and the rise of new technologies" (Huizingh, 2011, p. 2) have influenced the shift towards more open innovation by making the closed approach seem outdated (Gassmann, 2006).

Since the extremes are rarely observed in the real world, openness of innovation is considered to be more of a spectrum, where innovation is judged within a range of openness rather than it being a question of open or closed innovation (Dahlander & Gann, 2010). Open innovation is largely divided into two dimensions, inbound and outbound, that each can be different degrees of open (Huizingh, 2011).

Inbound open innovation is the internal use of external knowledge, where outbound open innovation is the external use of internal knowledge. Studies have shown that firms tend to use inbound more often than outbound open innovation (Huizingh, 2011). The three most common open innovation practices that can be both inbound and outbound are licensing agreements, non-equity alliances, and the purchase or supply of technical and scientific services (Bianchi *et al.*, 2011).

Companies that use outbound open innovation often find it rewarding and report net gains, which has forced researchers to speculate whether there might be an under exploitation of the external environment in innovation processes (Huizingh, 2011). Giving the outside access to internal knowledge obviously scare most companies, as the fear that additional knowledge will unintendedly flow through the open channels, eliminating some of the competitive advantages the company gains from their knowledge related resources and capabilities (Huizingh, 2011).

5. Classic Theory on Industry Clustering

The classic theory on clustering of industries was pioneered by professor Michael E. Porter and is rooted in the industry-based view on business strategy explained in the literature review. Porter defines an industry cluster as a "geographic concentrations of interconnected companies and institutions in a particular field." (Porter, 1998, p. 78) and argues that these interconnections are the source of several competitive advantages gained by clustering. The interconnected activities relate highly to the framework of Porter's 5-forces which is the pillar of the industry-based view.

All of the 5 industry forces considered by the industry-based view are usually factors in an industry cluster. The clustered environment compresses a full industry into an area with both competitors, suppliers, buyers and manufacturers of complementary products being present locally. An industry cluster is also, much like a regular industry, influenced by the outside environment in the form of government and institutions (Porter, 1998). A clustered industry might even be more affected by these forces as the local government and institutional network are important factors in determining the outcome of the cluster (Porter, 1998).

When considering the external as a supportive factor of an industry cluster, it is important to keep in mind that clusters of industries rarely tend to conform to geographical boundaries. Because clusters often cross state or national borders when evaluating the supportive network around a cluster, it is not sufficient to just consider the overall politics of the area. Clusters will tend to grow where they are supported and political borders, regionally or locally, often become the true enforcer of cluster boundaries as they implicate the cluster environment in a more significant way than geographical ones (Porter, 1998). A cluster will flourish where the regulations and support system facilitate and favors the business environment.

As clusters provide a new perspective on the importance of location, it challenges business leaders to be creative in taking advantage of the local area and how to integrate it in their strategy. These external factors can be used and misused in many different ways, but overall, they provide companies in clusters with advantages and opportunities from being present in the local area (Porter, 1998). The quality of the local environment therefore becomes a strong influence on how the competition inside a cluster unfolds and how sophisticated the companies are able to be in their competitive strategy.

The following section will outline the most apparent motives for industry clustering as defined by the classic established theory on the topic. According to Porter's classic cluster theory, advantages gained from clustering

relate to supply chain activities, a strong worker pool, the institutional network, and a supportive local government.

SUPPLY CHAIN

Industry clusters are much more than competing firms located in close proximity. Clusters extend upstream and downstream including all parts of an industry from supplier to buyer, but also often extends horizontally as related industries are usually present in the same industry cluster (Porter, 1998). A clustered industry is based around a collection of competing firms, but it features and relies on a large array of other industry players that together create the ecosystem that largely allows for a company to carry out their supply chain activities exclusively within the cluster.

Theory on transaction costs economics states that the number of transactions a firm engages in on the open market is determined by the relation between the cost of administrating that service within the organization and the cost of buying that service from the market (Williamson, 1991). Transaction costs are defined as the time and effort necessary to establish the transaction or exchange. This involves costs of gathering information and searching the market, time dedicated to establishing the relationship or to enforce the agreement if necessary, and the abstract cost of taking on the risk that follows when relying on an independent agent (Williamson, 1991).

These transaction costs are significantly lowered in industry clusters. Having the market concentrated in the local area makes searching for the right partner easier and building relationships smoother as distance is no longer a hurdle, making information less obscured and interactions more frequent (Porter, 1998). Stronger relationships and less obscured information make security measures such as quality control available and naturally decreases the risk of using the market. It also helps to negate the risk that the local government is able to enforce contracts. Overall, clustering makes the market a better option for companies and they can instead focus on only having the transactions where they create most value in-house (Porter, 1998).

Typically, relying on the market for supply chain activities involves a large amount of transaction with buyers and sellers spread out across the global business world. The physical distance and lack of codependency makes it difficult to establish business relationships (Porter, 1998). Compared to relying on scattered market transactions, a cluster environment brings many links of a company's supply chain into close proximity.

Clustering represent a value chain organizational form that exist somewhere between using the external market and having the links integrated (Porter, 1998). It resembles the structure of vertical integration where parts of the supply chain are inside the organization, but without the inflexibility of being locked to that supplier, distributor or another supply chain activity because you own it. Integrating the supply chain gives an organization more control over its supply chain activities and performance, but the integration process is very costly

and afterwards it demands a lot of resources to continuously ensure that your own supply chain links are up to date with what the market can offer (Porter, 1998).

Relying on members of the industry cluster for your supply chain activities greatly decreases the resources usually required for managing and maintaining networks, partnerships and alliances when using the global market. At the same time, it provides a firm with better control over their value chain activities similar to the advantage of vertical integration, but without the large initial and continuous investment of resources. Because suppliers, buyers, and such are located in proximity it allows for frequent interactions, quality control, cooperation, relationship building and other activities that improve the outcome of the partnership (Porter, 1998).

To sum it up, the environment of an industry cluster enables firms to adopt an organizational structure that resembles the vertical integration model to a degree by allowing for strong business relationships across the supply chain within one geographical location but with the flexibility of being able to change if the outcome is no longer as desired. "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, p. 80). This geographically concentrated market of industry-related suppliers, buyers, distributors and other supply chain activities provides a competitive advantage and it is a main reason why companies locate in industry clusters.

Worker Pool

Urbanization, agglomeration of industries, and human capital accumulation go hand in hand. As urban areas grow, more companies will seek to locate there because of the obvious advantages (Porter, 1998). One of those advantages is the amount of skilled labor present in these areas as more people live there, but also a larger variety of educational opportunities exists in these larger cities. As industries cluster, the demand for specialized or skilled labor increase and that leads to an increased spending of resources in developing this human capital, which then attracts more people to the area and the industry cluster (Woodward *et al.*, 2006).

Companies located in a cluster rely heavily on the quality of available employees in the area (Silicon Valley Leadership Group, 2015). Without a high number of workers that are well-educated within the industry-specific field, companies will be limited in the scope of their competitive strategy (Woodward *et al.*, 2006). A higher quality workforce provides companies with a wider array of actions and allows for a more complex competition inside the cluster (Porter, 1998).

Companies will cluster because it creates a large demand for specialized labor which attracts talented people and inspires the creation of educational programs related to the industry (CBRE, 2020). An industry cluster is collectively able to influence local universities to educate workers for the industry and engage in cooperative educational and research programs with industry players to create specialized workers (CBRE, 2020). Access

to specialized and well-educated labor is definitely a reason why companies locate in clusters and the higher the quality of industry educated workers, the stronger the competitive advantages for the local companies (Porter, 1998).

INSTITUTIONS AND GOVERNANCE

An industry cluster is usually supported by a variety of institutions, both governmental and privatized, which facilitates a rich environment of education and research related to the local industry (Porter, 1998). This includes universities, agencies, think tanks, providers of specialized training and education, information research, and technical support (Porter, 1998).

Part of the institutional network is governmental and the way a region is administered can make or break the competitiveness of a local industry cluster (Porter, 1998). While governance can indeed help an industry cluster in a number of ways, it can also suffocate the business environment completely. Regulatory ambiguity and a court system that operates slowly and unfairly are incredibly damaging factors for the efficiency of an industry (Porter, 1998). On the other hand, a supportive governance can create a great environment with many possibilities for the industries operating within (Porter, 1998).

5.1 THE IMPORTANCE OF LOCATION

The existence and sprawling of industry clustering (Silicon Valley Leadership Group, 2020) show the continued importance location has in gaining competitive advantages that aren't easily imitated or negated by low-cost competitors. Porter states that: "The enduring competitive advantages in a global economy lie increasingly in local things – knowledge, relationships, motivation – that distant rivals cannot match." (Porter, 1998, p. 78).

If a high percentage of companies in an industry are located closely, we can be fairly sure that there are competitive advantages in being present in that particular location. Though the role of location has changed over the years, its significance has not.

Years ago, location was fundamental for a business because it could help bring down costs, like being located near a harbor or in a place where cheap labor was available (Porter, 1998). As the world gets smaller through globalization and the business environment becomes increasingly dynamic, cheap labor, infrastructure and suppliers become available to most companies regardless of location. In this way, the competitive advantage of being able to bring down input costs by locating in the right place becomes less decisive (Porter, 1998).

If in the past competitive advantages came mainly from bringing down your input costs, it can be argued that in the modern world the use you get from those input costs is at least equally important. When companies can

access most of the world markets because of globalization and therefore access the same input, truly competitive advantages must come from being able to gain more productivity than competitors from similar input (Porter, 1998).

The ability to get more use out of input than your competitors get from the same input still heavily relates to location though. Locating in the right area with a strong external business environment is as important as ever. The location specific parameters that increase productivity are the important ones now such as education, research, employee motivation, and potential cooperative partnerships. These factors that enable boosting productivity are still profoundly stronger in some locations than other, and therefore they become as important to businesses when choosing location as a natural harbor or cheap workforce was in the past (Porter, 1998).

5.2 Not Getting Left Behind

The reasons for locating your company in an industry cluster are mostly related to positioning the business in proximity to competitors and thereby gaining access to the same cluster facilitated advantages they have (Porter, 1998). Locating amongst competitors is not only an advantage, it also changes the competitive nature of the industry and companies should be aware of how.

A cluster not only facilitates an industry environment rich on suppliers, buyers, and quality workers – but also rich on competition. Businesses inside a cluster compete intensely against each other, fighting to win and retain customers and increase or protect their market share (Porter, 1998). The competition is a vital part of a cluster's environment as Porter (1998, p. 79) states: "Without vigorous competition, a cluster will fail.".

Porter (1998) argues that clusters affect competition in 3 ways:

1. Increases productivity
2. Drives innovation
3. Stimulates the formation of new businesses

Increases productivity

Porter's (1998) argument that companies within a cluster is more productive than a company outside the cluster with similar input is based on several factors. Inside an industry cluster, there is often better access to employees and suppliers, which lowers the overall search costs and transaction costs endured by the company. A well-established industry cluster will over time have accumulated extensive amounts of industry-related information that flows amongst the actors inside. The presence of complementarities to the industry inside the cluster unlocks a wide array of possible linkages and synergies resulting in a whole that is larger than the sum of its

parts. These factors, along with facilitating a greater foundation for cooperation with institutions and the motivational factor of fierce local competition, is the basis for Porter's (1998) statement that clustering enhances productivity.

Drives innovation

According to Porter (1998), clustering not only promotes competition, but also cooperation. Where competition is intense among rival companies, cooperation is heavily featured vertically and horizontally in the sense that firms corporate with the supporting environment e.g. local institutions and related industries. This is what Porter (1998) means when stating that a cluster drives innovation. Companies gain an ongoing ability to innovate because of the relationships gained from proximity to buyers, suppliers and other industries in the cluster. This close business environment allows companies to more easily experiment with product innovation and testing with both suppliers and buyers. It also exposes them to more stimuli from the local environment than more distant and isolated companies in terms of evolving technology, customer demands, and many other drivers of innovation (Porter, 1998).

Stimulates the formation of new businesses

The third way a cluster affects competition is also related to the fact that all aspects of an industry agglomerate in proximity. The concentrated environment of a cluster means that most new companies that enter the industry, does so within the cluster rather than outside of it (CBRE, 2020), because the cluster provides easy access to all necessary channels (Porter, 1998). "Needed assets, skills, inputs, and staff are often readily available at the cluster location, waiting to be assembled into a new enterprise." (Porter, 1998, p.84). Most commonly, new entries to an industry cluster are suppliers to the existing industries within the cluster. Related industries that draw on similar things are often present in the same cluster which provides suppliers with great opportunities (Porter, 1998).

5.3 Clustering Consolidates the Industry

Often the companies present in a cluster are linked across the supply chains in different versions of buyer-seller relationships. The relationships inside a cluster extends both upstream, downstream and laterally truly resembling the regular world market, but in a smaller locally supported ecosystem (Porter, 1998).

All in all, Porter's (1998) three arguments for how clusters affect competition and increases competitiveness of clustered firms implies that clustering of an industry solidifies that industry around the actors inside the cluster leaving rivals outside the cluster behind. Companies inside become more productive with similar output, drive the direction of industry innovation, and new entries to the industry will most likely be created inside the cluster.

In his cluster theory, Porter (1998) acknowledges the importance of what happens inside a company, but similarly to the industry-based view, most emphasis is put on the environment outside of the company. According to this view on clustering, companies should cluster because they are left behind if they do not. Clustering of industries is bound to happen because of its clear economic advantages and companies have to adapt to this external environment or they will be left behind. It is all about positioning themselves according to the external forces.

This theory on clusters compares directly to the industry-based view on strategy and Porter's 5 industry forces. Porter (1998) argues that companies should locate in clusters or they won't be competitive. In clusters, suppliers, buyers, and complementary industries are present and most likely to be a positive force rather than negative, because the basis for cooperation is much better within a cluster. The additional forces of government and institutions are also much more likely to be a positive industry force inside clusters, because the cluster only grows where local governance supports it and the institutional network grows and evolve in unity with the cluster being much more codependent.

Clustering of industries facilitates cooperation across many levels but at the same time increases competition since every company seeks to be located in the cluster to receive the same competitive advantages as their competitors. This mix of cooperation and competition is what defines an industry cluster according to Porter's (1998) cluster theory. When discussing why these two opposites can be present at the same time, Porter explains that "competition can coexist with cooperation because they occur on different dimensions and among different players." (Porter, 1998, p. 79).

6. Alternative View on the Clustering of Industries

6.1 Industry Clustering From a Knowledge-based View

Opposed to Porter's industry-based view, the resource-based view on business strategy has a focus on the internal environment of a company. From the resource-based perspective, value comes from resources and capabilities rather than being able to position yourself correctly within the industry. An extension of the resource-based view is the knowledge-based view, which has the same internal focus on the resources and capabilities of the firm. The knowledge-based view argues that the most valuable resources and capabilities are knowledge related.

When acknowledging knowledge as a driver of value, it becomes relevant to reconsider the concept of knowledge and how it appears inside an industry cluster. Instead of focusing on matching competitors by accessing the same knowledge source as them and thereby negating the competitive advantage, knowledge could be viewed as the resource that gives a firm sustainable competitive advantages that cannot easily be negated. If a firm manages their knowledge-related resources and capabilities well, then it is not only a key to staying competitive but a key to growth and value-creation (Gertler, 2003).

The knowledge-based perspective, as explained above, allows for a more focused definition of an industry cluster. It considers an industry cluster as a knowledge-intensive environment where industry actors come together to form a community that facilitates the sharing and creation of knowledge in cooperation between companies and a support network. The clear attraction to clustering can be boiled down to the supportive community and how it helps a company to improve their organizational capabilities related to gaining value from knowledge.

Porter keeps his focus on the industry and how a company should position itself within that industry and in relation to the competition. His cluster theory therefore uses the concept of knowledge being a key to productivity to state that a company should locate in a cluster because that is where the most educated workforce is. He argues that if a company does not have access to this workforce i.e. knowledge, they will fall behind their competitors who will be able to gain more productivity from the same input (Porter, 1998).

Morosini (2004) views industry clusters with a more knowledge-based perspective, describing them as social communities of economic agents localized in close proximity. He argues that a significant part of the cluster "works together in economically linked activities, sharing and nurturing a common stock of product,

technology and organizational knowledge in order to generate superior products and services in the marketplace." (Morosini, 2004, p. 307). Morosini states that an industry cluster is not just competing firms gathering in proximity, but that we have to include "a social community of people and a broad set of economic agents" (Morosini, 2004, p.308) in addition to Porter's (1998) definition.

6.1.1 Narrowing the Scope of Industry Clustering

While not paying too much attention to the internal environment of the firm but rather focusing on the external environment and the industry the firm operates in, Porter does acknowledge that in the modern age, competition revolves more around productivity than access (Porter, 1998). Essentially, this describes how competition once depended on which resources a company had access to and the abundance of those resources in the local area. The global world and distance mattering less has changed that and now competition is fundamentally based upon what usage and output a company can get from a resource.

Porter's definition that clusters are geographic concentrations of related companies created some confusion as to when an agglomeration of businesses is purely geographical as the result of urbanization (Morosini, 2004). Historically, large cities have grown from places with strong natural infrastructure such as flat landscape and access to river or sea. In more recent time, large cities have become a natural place for great education, large labor market, grand transportation networks and other factors that provide local companies with competitive advantages (Morosini, 2004).

Morosini (2004) argues, that when using Porter's definition, large cities as a result of urbanization will always be classified as industry clusters, because these areas provide businesses with economies of scale from locating in the area and therefore industries will naturally cluster. The issue is that the governance of these large urban areas rarely puts business and economy first, but rather focuses on human and social development (Gordon & McCann, 2000). In addition, large cities will have more industries clustered in the area and therefore institutions such as universities, research centers, and so on, will be less directly related and attuned to the specific industry cluster and its performance.

This distinction is important to make because the supportive system in a cluster plays as big a role as it does both according to traditional theory and the knowledge-based theory. Understanding if the governing body and institutional network has grown and evolved alongside the clustered industry and become integrated as valuable support, or if it is simply present unrelated to the industry cluster and acts independently and impartially, can be significant to any analysis of a cluster's potential. Morosini (2004) argues that a social network of different interrelated entities is an integral part of any industry cluster. Several supporting institutions play a role in providing businesses in the cluster with competitive advantages over rivals not located in the area (Morosini, 2004).

“Empirical evidence suggests that close-knit social communities are a significant factor behind the economic strength and sustainability of industry clusters” (Morosini, 2004, p. 309). This importance that the regions supportive institutional environment has for a cluster’s performance and the competitive advantages it can provide to local companies is arguably one of the main motivations for companies to locate within an area where institutions are well-established as an integrated supportive network for the cluster.

The knowledge-based perspective would be more interested in the cases where industries cluster because they seek the advantages from being located amongst each other in close proximity. This lets us ignore the urban agglomeration where companies cluster because of the natural economic advantages of being present in large cities. The industry clusters that sprawl from the wish to locate amongst other industry players and where local governance has the business environment as its main focus are the ones relevant for this thesis. This is where knowledge transactions and interactions are deliberate and essential instead of being a more randomly distributed byproduct.

In most cases, local governance will be on board with industry clustering in their area, especially when the area is relatively less economically developed or is not viewed as a strong strategic location (Morosini, 2004). Mostly because an industry cluster often brings great potential for employment, economic growth, investments and other critical resources that helps develop the local area overall (Morosini 2004).

The governing body of the industry cluster – be it local, regional, or even national – can as a supportive driver assume different roles (Morosini, 2004):

- Initiator

  Political decisions are typically what paves the way for the emergence of an industry cluster. Liberalization and deregulation are key drivers for a sprawling business environment. Politics can even lead the evolution of an industry cluster down completely new paths. This is rarely deliberate but can be a game changer if nurtured correctly.

- Promoter

  The local government can support the industry cluster by promoting the products and services of the cluster. This can also include promoting the image of the cluster or networking trade negotiations both nationally and abroad. Long term, a promoting government can invest in local infrastructure that benefits the industry cluster or promote investments in infrastructure that improves the clusters export possibilities.

- Coordinator

  In some cases, the local government can support an industry cluster more directly by being an active

part of the cluster activities, carrying out tasks such as benchmarking, advising on best-practices, managing technology transfers, and assisting with expertise.

Regions where governance is lenient and supportive of the local business environment will attract companies and therefore, we observe clustering of industries in such areas. Additionally, an advantage of clustering in areas with this type of environment is the collective strong voice that the companies will have in legislative debates or in lobbying for initiatives and regulations that benefit the industry cluster.

6.1.2 Redefining the Industry Cluster

The pure local gathering of suppliers, producers and buyers in a cluster does potentially create value and competitive advantages, but the social community within the cluster could be the key to unlocking this potential and realizing the true value of industry clustering. This phenomenon is what literature on the subject refers to as 'the glue'. Porter (1998) calls it 'the social glue', others call it 'common glue' or 'organizational glue' (Morosini, 2004). No matter the name, they all have the same point: the true advantage of clustering is the interlinked network that can be established within.

Morosini argues that a cluster needs to possess 5 distinct capabilities in order to build this 'common glue' and realize its potential (Morosini, 2004):

- Leadership

  If the community of an industry cluster is united under the leadership of individuals who are explicitly considered by all to have key roles inside the cluster, then the cluster will have a better chance of developing a well-functioning cooperative environment. The degree to which these leaders are broadly accepted by the different agents operating in the cluster, depends on how well they are able to represent the common interest of the cluster. For instance, if cluster leadership fails in being objective when sorting out internal disputes, that are not a legal question by nature, it will hurt the cluster environment ability to facilitates knowledge sharing, leadership coaching and cooperation.

- Building Blocks

  A well-functioning industrial cluster will over time build a pool of common knowledge that is shared across all parts of the community inside the cluster. This common knowledge serves as a great foundation for collaborative activities inside the cluster. The building blocks of this foundation of common knowledge are many, including a common code of behavior that helps build trust in collaborations. Key to smoothening collaborative engagements inside the cluster is the development of common culture which stems from a common worker-pool that is used by all parties of the cluster and in which the companies engage in developing the human talent. Collaboration is further emphasized by the

existence of common language and terminology, a common philosophy in the education of the future workforce, and a common approach to performance measurement. All these common approaches to business, along with a strong supportive network that spreads the value across the entire cluster, makes for a well-performing industry cluster both economically and innovatively.

- Communication Rituals

  Having common rituals is the key to creating a common identity for the industry cluster. Engaging in events and interactions regularly helps establish an identity that all member of the cluster can stand behind. An industry cluster with high level of interactions is associated with higher levels of cooperation, but it also helps the competitive strength of the cluster. Standing together with a common identity strengthens an industry clusters providing it with abilities such as lobbying governments and building their image through larger-scale PR events. An industry cluster with a common identity and higher levels of interactions is also shown to be more adaptable to changes in the macro environment.

- Knowledge Interactions

  If knowledge is the most important resource for a company and developing knowledge-related capabilities is key to be competitive and grow, it becomes important for a cluster to facilitate interactions where knowledge can be shared and gained in a mutually beneficial way. The most obvious ways that a clustering helps an industry realize the true potential of knowledge as a resource is by establishing a supportive network of institutions that facilitate knowledge-creation. In a well-functioning industry cluster, we often see research centers, universities, think-tanks, training programs and such that help produce knowledge relevant to the industry (Woodward *et al.*, 2006). This also helps to promote collaboration where firms actively shape knowledge-creation so that it benefits the common knowledge pool as best as possible. When these supportive knowledge-related institutions are partly shaped by the clustered industry, collaboration between the actors in that industry and the institutions becomes second nature. In strong industry clusters, the supportive knowledge-related institutions often function as both initiators and managers of knowledge interactions between members of the industry throughout the supply chain all the way from suppliers to customers.

- Professional Rotations

  "Within highly competitive industrial clusters, there is typically a significant pool of human talent specialized around business and technological knowledge that is specific to the cluster's main economic activities." (Morosini, 2004, p. 311).

  The degree of interfirm mobility of employees that goes on within an industry cluster has been shown to correlate with the degree of tacit knowledge sharing (Morosini, 2004). A continuous flow of skilled

worker migrating within a cluster drives the creation of a common knowledge pool of experience and best practices (Silicon Valley Leadership Group, 2015). In addition, it also contributes to the creation of new knowledge as people with different know-how and experiential knowledge is combined more frequently (Silicon Valley Leadership Group, 2015). A high degree of professional rotation increases both knowledge sharing and innovation in a clustered industry.

Establishing the "Common Glue"

Leadership	Building Blocks	Communication Rituals	Knowledge Interactions	Professional Rotations
Explicit Leaders improve the cluster if: Leaders are accpeted by all members of the cluster Leadership succeds at: - Coordinating knowledgesharing - Coaching future leaders - Handling inter-cluster disputes - Representing the vision of the cluster and driving change	Strong sociocultural ties across the cluster helps promting collaboration through: Common code of behavior - Enhances trust among agents of the cluster Common - language/terminology - culture - approaches to developing human capital - understanding of business - approached to performance measurement	Creates a common indentity through: - Regular events - Regular interactions - Regular approaches	Knowledge-related institutions (universities, think-tanks, reasearch centers) support the clustered industry by: - Creating industry relevant knowledge - Initiating collaborations within the cluster - Managing collaborations within the cluster	Knowledge sharing within the cluster correlated highly with: - The degree of own-sector employment within the cluster - Interfirm mobility of the workforce within the cluster - Spin-offs/Start-ups by cluster-educated employees

Own creation - based on: *Morosini, P. (2004). Industrial Clusters, Knowledge Integration and Performance. World Development, 32(2), 305-326.*

6.1.3 Two Different Views on Industry Clustering

Traditional theory on industry clusters suggests that the performance of a cluster can be measured through the economic linkages present within a geographical agglomeration of all the different parts of an industry. They argue that the advantage of clustering lies in the having all operations throughout the supply chain, vertically from supplier to customer and horizontally from related industries, gathered in the local area. The strength of these economic linkages determines the competitive advantage that firms present in the cluster gain over rivals outside the cluster.

The traditional view is that firms cluster to get access to the competitive advantages existing in an industry cluster, which additionally to the economic linkages also often include a strong worker pool, institutional network, and a supportive government. The knowledge-based perspective would broadly agree with these advantages of clustering, but instead of viewing access to resources as the reason to cluster, this perspective is interested in how clustering can improve an organization's own capabilities and resources.

A knowledge-based theory on industry clusters would question the sustainability of the advantages gained from locating where the industry has agglomerated, by claiming that these can be imitated by other geographical agglomerations. It becomes important to distinguish between industry-specific location related advantages such as sharing a pool of skilled workers, knowledge flows, and supportive institutions – and more general urbanization advantages that span across all industries agglomerated in the area. Expanding the view on industry clusters, this theory suggests that the social perspective of an industry cluster should be equally important when evaluating the performance of an industry cluster.

A KBV conclusion would be that the way an industry cluster is able to facilitate an environment where knowledge can be shared and created in cooperation with a supportive social community that initiates and manages the flow of knowledge is the main reason companies should cluster. The degree to which an industry cluster is able to integrate knowledge and cooperation is crucial to its overall performance, growth, and ability to compete with other clusters (Morosini, 2004). The endgame of an industry cluster should not be to solidify against distant rivals, but rather to establish a 'common glue' that encourages and smoothens knowledge-integration and mutually beneficial cooperation.

6.2 The Industry Cluster as Facilitator of Knowledge Sharing

This chapter analyzes the distinctive capabilities of a cluster and how its environment is a perfect facilitator for cooperative activities and knowledge sharing, not only with the support system, but amongst competitors. Any analysis of the benefits from locating amongst competitors needs to include a discussion about the risk of knowledge spillover.

6.2.1 The Risk of Knowledge Spillover

We know that knowledge flows related to a certain industry is superior inside a cluster of that same industry, and so being located in a cluster becomes incredibly valuably for firms who are better at managing knowledge than their competitors. Still though, probably the biggest reason for staying out of a cluster is the risk of knowledge-spillover (Alcácer & Chung, 2007). Since tacit knowledge is widely recognized as a key driver of success (Grant, 2016), it becomes relevant to understand how to retain and manage that valuable resource. When theory argues that knowledge is best transferred in close proximity that is also true for the unintended transfer of knowledge (Grant, 2016). If the argument that knowledge is the most valuable resource holds, then firms that are greater at managing knowledge should be at higher risk, since they have a larger amount of it

and therefore more to spill. Lesser companies will flock to gain some of the knowledge from their superior counterpart inside a cluster (CBRE, 2020).

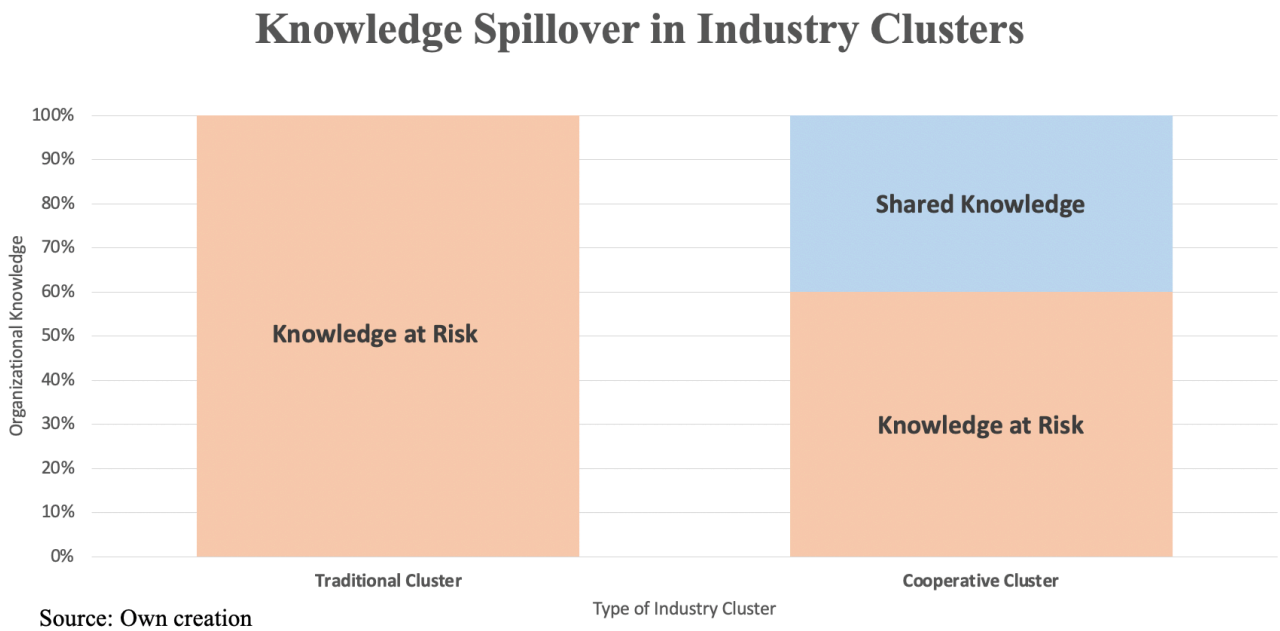
This raises the question as to whether the benefit knowledge-intensive organizations gain from clustering is greater than the risk involved. A company that excels in getting value from knowledge will flourish in a cluster environment where knowledge is heavily integrated through a strong 'common glue' and social supportive community. In such an environment knowledge inflow increases, thereby increasing the value created for the company.

On the other hand, an environment where knowledge flows bring with it the threat of unintended knowledge spillover. Clustering is described above as a beneficial move for a knowledge-intensive company, but with a knowledge-based view on strategy where knowledge is the most valuable resource and source of competitive advantages, the risk of knowledge spillover becomes an even larger deterrent (Alcácer & Chung, 2007). If companies are heterogeneous in their knowledge base, meaning the organizational knowledge is what determines strategy and gives value, it also makes the risk of losing it even worse. "A firm that spills valuable knowledge to its competitors may see its competitive advantage erode." (Alcácer & Chung, 2007, p.763).

Poaching of specialized labor between firms is the source of knowledge spillover that is increased the most when competitors locate in close proximity (Morosini, 2004). Increased worker mobility between rival companies inside clusters means that firms have to accept the higher chance of their acquired knowledge being employed by other organizations (Fallick *et al.*, 2006).

Overall, because the close proximity and shared social community open a lot of channels for knowledge transference within a cluster, a lot of the knowledge that exists or is created at a firm-level naturally accumulates on an industry-level in a pool of shared market intelligence (Morosini, 2004). Therefore, a disadvantage of locating in an industry cluster is that innovation and technology gets imitated by competitors at a much faster rate (Morosini, 2004).

From a knowledge-based perspective on strategy, it is difficult to argue against the fact that technological leaders should avoid clustering because they have more to lose and less to gain. However, there is a way to mitigate the amount of knowledge at risk. Unintended knowledge spillover can be replaced by intended knowledge sharing. If you increase intended knowledge spillover, then by the law of inverse proportion, unintended knowledge sharing should decrease because some of the knowledge at risk is now transferred willingly, receiving something in return instead of it being 'stolen' (*as illustrated below*).



Source: Own creation

Agglomeration of an industry does provide an environment where it should be possible to create and establish a culture of knowledge sharing amongst competitors. The rest of this thesis will seek to analyze how clustering enables and facilitates cooperation between rivals and if this could be the key to unlocking the true potential of an industry cluster.

6.2.2 Clusters Facilitate Knowledge Sharing

Like Porter (1998), Morosini (2004) emphasizes cooperation with entities that have a more industry-supportive role inside the cluster, but not as much cooperation between competitors. Still, Morosini's arguments that a well-established cluster through cooperation can generate innovation that produces superior products and services, is the basis for this paper's proposition that competitors should cooperate in clusters.

If a cluster can facilitate a network of cooperation between an industry and the supporting entities in the social community inside the cluster, which entices companies to locate in close proximity, then it might be possible to extend that network to also include cooperation between the competing firms inside the industry cluster.

When a portion of the major players from an industry locate in close geographical proximity, it intensifies the competitive landscape of that industry (Morosini, 2004). This is the most apparent disadvantage of industry clustering, but it can also prove to be an advantage. If a cooperative spirit can be established amongst cluster firms, an industry cluster can serve as a great facilitator of alliances, partnerships, and cooperation in general. If a cluster intensifies competition, it could also intensify cooperation.

Where traditional theory on industry clusters talks about the competitive advantages of locating in areas where large parts of the industry has agglomerated over time, this thesis is more concerned with the advantages that competing companies can get from locating amongst each other in close proximity.

If both parties are present in the same industry cluster, it eliminates many of the natural obstacles of cooperation. Initially, locating in proximity eliminates the obstacles of long-distance partnerships where the degree of control is minimal, and interactions are less frequent (Morosini, 2004). Being active for a longer time in the same cluster environment further eliminates many of the cultural obstacles in partnerships as commonalities increase and the common 'glue' (Morosini, 2004) gets established.

The network of cooperation that Morosini (2004) talks about is the set of linkages that bind together the members of an industry cluster. The amount of linkages and the nature of these linkages significantly impact the knowledge-based advantages generated in the cluster and they grow as commonalities increase (Morosini, 2004). Furthermore, findings have shown that industries, where multiple linkages can be created among the competing firms, show greater growth than less linked industries (Morosini, 2004). The fact that indirect linkages among competing firms are likely to enhance the industry overall, makes it interesting to consider if establishing direct linkages between competitors can have a similar, if not improved, effect on the industry.

In a well-established cluster, companies will be linked in numerous ways that allow for much smoother transitioning in and out of collaborations. Competing companies in a cluster often have common suppliers and service providers, use the same infrastructure and draft from a common talent pool of skilled labor (Morosini, 2004). They also interact with a common social community of educational programs, universities and research centers.

The supportive community inside the cluster, which Morosini (2004) refers to as the 'social community' is an important factor in promoting the sort of cooperation that enhances the performance of participating firms located within the cluster and as Schmitz (2000) concludes: cooperating firms perform better than non-cooperating ones.

6.3 THE INNOVATIVE CAPABILITIES OF AN INDUSTRY CLUSTER

It is the tacit knowledge that is key to creating value and driving innovation, but as mentioned, it is also the type of knowledge that is most difficult to share (Gertler, 2003). The sharing of tacit knowledge often requires regular interactions, which is why a cluster environment is perfect for facilitating these knowledge transactions. Studies of knowledge spillover show that new findings will spread rapidly to closely located

organizations and then as time passes, this newly created knowledge will travel more widely to geographically distant organizations (Feldman, 1999).

6.3.1 Tacit Knowledge Sharing in an Industry Cluster

As the world develops into an increasingly global market, explicit knowledge loses its value by becoming more easily shared, traded, and accessed. Explicit knowledge turns into well-known best practice guidelines for all informed players in the industry (Gertler, 2003). What you do with this industry-related explicit knowledge is what really sets a company apart from the competition, and that requires a strong base of tacit knowledge. That is why tacit knowledge build up from experience becomes so important and why it is valuable to interact with sources of tacit knowledge as frequently as possible (Alcácer & Chung, 2009). If everyone has the same information, you want to interact with and learn from those that gain the best outcome from it. Engaging in knowledge-related activities and interacting through knowledge-creation is the best way to share tacit knowledge (Maskell & Malmberg, 1999).

When an industry agglomerates in a geographical location, it is a fairly certain occurrence that a supportive network or social community starts organically developing around the industry, forming an industry cluster. This happens because the valuable knowledge is more likely to be shared when parties are always in close proximity and thereby regularly interact (Alcácer & Chung, 2007). In this way, tacit knowledge is a big reason why we observe clustering of industries (Gertler, 2003).

It is important to note that two additional reasons exist for why tacit knowledge is better shared in clusters. Firstly, Gertler (2003) argues for the importance of a shared social context in determining the efficiency of tacit knowledge sharing. Secondly, he states the importance of a knowledge-related supportive environment in the form of institutions and organizations that add to the knowledge flow (Gertler, 2003). This adds to the argument that both a shared social context and a network of knowledge-related institutions are parts of the 'common glue' (Morosini, 2004) which should be integrated in the definition of an industry cluster.

That social community which according to traditional cluster theory naturally sprawls in a well-established cluster includes education, and they could play a very important role in the knowledge sharing activities of the cluster (CBRE, 2020). Universities have shown to spur growth and innovation in the local area through research and development programs (Woodward *et al.*,2006). In the regular business landscape, universities will often focus on how to utilize the large high-profile companies to commercialize their research result and educational programs (Grimaldi *et al.*, 2020). Instead, inside a knowledge sharing cooperative cluster, universities could take on an assisting function, supporting the industry with their own innovative activities and engaging in cooperation with firms (Grimaldi *et al.*, 2020).

Leveling the playing field between large firms and universities is not an easy task though, but through the proper mix of opportunity structures and incentive schemes, it should be possible to integrate university research into the operational working of an industry cluster (Sørensen & Fassiotto, 2011). A cooperative cluster, as explained so far, would feature less bureaucracy, hierarchical control and dominant firms, which leads to better knowledge absorption from universities to industry firms (Saxenian, 1994).

6.3.2 Competing Against Other Industry Clusters

Industry clusters are born all over the world and at much faster pace than expected (Startup Genome, 2020). The number of these business ecosystems has grown exponentially in recent years with the amount being nearly doubled from 2017 to 2019 (Startup Genome, 2020). Clustering has clearly become an increasingly regular phenomenon, and that might change the competitive landscape as well. Porter (1998) describes the reason for clustering as a way to gain competitive advantages not available to rivals outside the cluster, but as Morosini (2004) explains: "Whereas the market focus of some of these industrial clusters might remain local, global competition can nevertheless take place in form of new entrants – which often include industrial clusters as well." (Morosini, 2004, p.312).

In other words, where Porter (1998) focused more on clustering as a way to gain something that distant rivals cannot and thereby solidify the industry against newcomers, a knowledge-based perspective is more interested in the long-term sustainability of the industry cluster. In a world where clusters are more likely to face competition from the formation of new clusters rather than just competing with sole distant companies, there needs to be a set mechanism to combat the dynamics of business competition (Morosini, 2004).

This mechanism could definitely be a mutually beneficial cooperative environment that enables the industry cluster to adapt to changes and drive innovation which keeps them competitive. Clusters with strong 'common glue' increase knowledge-related interactions (Morosini, 2004) and tacit knowledge is best shared through interactions (Gertler, 2003). Since tacit knowledge is a central component for innovation, it can be argued that innovation capabilities are stronger in cooperative clusters than anywhere else.

6.4 Cooperation is Beneficial to the Collective

As explained in the literature review, Hargadon & Sutton (2000) presents their four-step continuous innovation process 'the knowledge-brokering cycle' as the key to becoming an 'innovation factory'. Their theory explains how an organization on a firm-level should act in order to enhance their own innovative capabilities, and a cluster environment seems to be a perfect place to engage in those activities. The theory on creating an innovation factory is based on inner workings of an organization. A cooperative industry cluster, as described by

this thesis, could be viewed as somewhat of a large collective organization, making it interesting to consider Hargadon & Sutton's (2000) innovation process in a cluster setting and how all 4 steps of creating an innovation factory are amplified from this perspective.

6.4.1 A Collective Innovation Factory

Hargadon & Sutton's (2000) innovation theory relies heavily on the inflow of ideas and building up as large a pile of ideas as possible because this increases the likelihood that one will turn out to be valuable, while also accumulating sources from which you can draw inspiration. In a cooperative cluster with a high degree of knowledge integration, the piles of ideas are larger, and sources of inspiration are plentiful. If all members of the industry cluster contribute to the innovation-related resources and capabilities of the collective, it could be possible to transition the cluster as a whole into an innovation factory, dominating the global market and staying ahead of other clusters of the industry.

First step of the innovation process is capturing ideas, and a cooperative cluster environment is full of them. By its very nature, an industry cluster compresses a large amount of ideas in a small space, making the process of scanning for ideas much less demanding as it can largely be done locally. In a cooperative-minded cluster, there is also a lot of potential for engaging in knowledge sharing activities where ideas are distributed.

Secondly, ideas must be kept alive in order to potentially be valuable. Hargadon & Sutton (2000) lists geographical distance and competition as two of the main killers of ideas, and within a cooperative industry cluster one is completely eliminated and the other is mitigated by paring competition with cooperation to compete on a cluster level against rivals outside the cluster. By its very definition, an industry cluster will not be affected by disadvantages from geographical distance and the cooperative nature helps to relieve some of the competitive friction away from the cluster by moving focus towards the competition against other clusters of the industry.

By facilitating frequent interactions, sharing of tacit knowledge happens more often and less distorted than it otherwise would, and ideas will be lodged inside the minds of more individuals (Alcácer & Chung, 2007). This mitigates another killer of ideas which is the issue that people leaving means losing ideas and tacit knowledge within them.

A key to keeping ideas alive is knowing who holds which knowledge (Hargadon & Sutton, 2000), and while the spreading of this information might not be directly enhanced by clustering, the amount of individuals who hold specific knowledge will most likely be increased, thereby making it easier to find and access the right knowledge at the right time. Additionally, with educational institutions working together with the firms in the cluster to train the future worker of the industry (CBRE, 2020), it allows the industry to promote some fields of the industry over others based on where new 'receptacles' of knowledge are needed. Designing the

educational programs in a way that specializes labor in certain aspects with titles that describe the sort knowledge they might hold is a way to spread information about who knows what.

The third step of the innovation process is to imagine new uses for old ideas, and the environment inside a cooperative cluster presents many and frequent possibilities for that activity. As Morosini (2004) explains in his work defining the 'common glue' of industry clusters, the day to day activities within a cooperative cluster environment frequently feature possibilities of exchanging ideas and thereby encourages reimagining. A co-operative cluster has regular events where individuals from different local firms can engage, interact, and approach each other with ideas and new thinking (Morosini, 2004).

The local institutions and support network will also initiate collaborative and explorative events that facilitates new thinking and reimagining of old ideas (Morosini, 2004). This could be universities initiating a collaboration between students with new ways of thinking and firms with old ideas that needs reimagining (CBRE, 2020). Activities like these can be a factor continuously present in the daily operations of a cooperative industry cluster, promoting new thinking and creativity. Additionally, industry clusters usually have high inter-cluster worker mobility (Morosini, 2004), which means that firm knowledge and old ideas are often exposed to new cluster educated individuals with their own personal tacit knowledge base.

Lastly, ideas with potential have to be tested as often as possible and as early in the process as possible. Industry clusters are not only an agglomeration of competing firms in an industry. A well-established cluster will always contain many, if not all, of the other aspects of an industry (Porter, 1998). This means that firms inside a cluster have easy access to suppliers, customers, institutions, and other groups of the industry that might be relevant for testing and experimenting with new concepts and ideas. The fact that industry clusters facilitate cooperation between the different links of the supply chain is broadly agreed upon by researchers and experts in industry clustering (Porter, 1998; Morosini, 2004). This cooperative potential certainly extends to testing and experimenting with new ideas and concepts. Simply put, implementing and integrating something new into your business activities is easier if all those activities are located the same place as you, and it also makes feedback and tweaking a much smoother part of the process.

OPEN INNOVATION

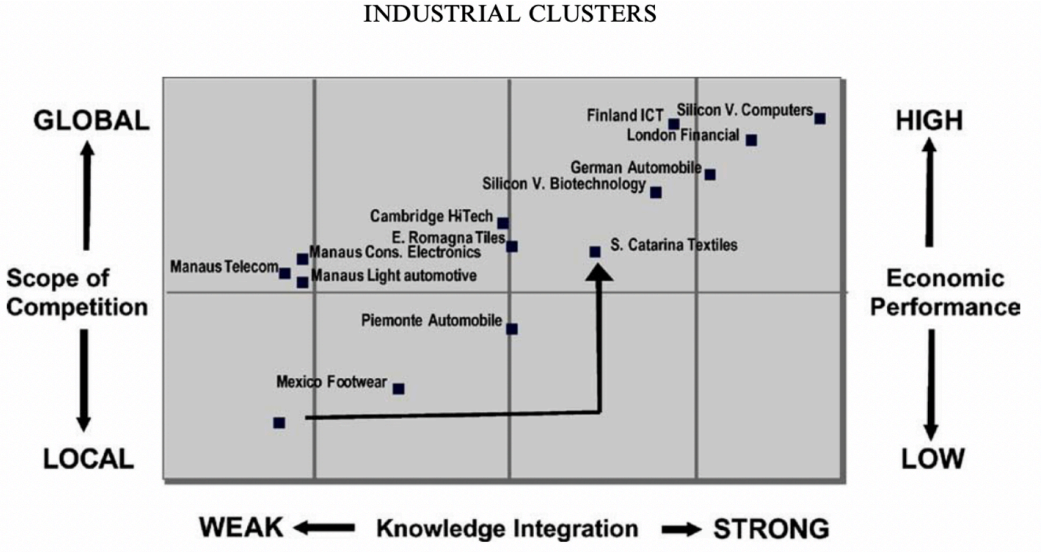
All in all, clusters provide perfect conditions for firms willing to engage in open innovation and this is why clustering with the purpose of engaging in mutually beneficial innovation can provide all parties with significant advantages against distant rivals. It is of course easier for a firm to exploit opportunities and knowledge sources in the external environment when the external environment is geographically clustered around them. An industry cluster facilitates a rich environment for firms seeking to utilize external knowledge in their innovation process. Therefore, inbound open innovation should be seamlessly adapted by firms acting in a well-

established industry cluster. The 'common glue' will naturally encourage firms to engage in activities where they can collect some of the industry knowledge existing in the common cluster network.

Additionally, a strong industry cluster should be able to encourage the use of outbound open innovation, as relationships are able to grow stronger and accountability is high leading to stronger trust between the clustered firms. Theory on open innovation argue that outbound open innovation is largely underused by firms, because of the risk involved with providing internal knowledge to an external entity, suggesting that it often ends up rewarding the engaging parties with gained net value (Huizingh, 2011). Clustering with a cooperative mindset and a strongly established commonness could provide the perfect environment for outbound open innovation where firms are comfortable sharing internal knowledge amongst each other in a collective pursuit to create innovative solutions the issues related to their industry and maybe even beyond that.

6.4.2 Everyone Benefits

Morosini (2004) builds on the knowledge-based perspectives hypothesis that an industry cluster performs stronger when knowledge is actively integrated in the fabric of the cluster through collaborative knowledge creation and sharing. His empirical evidence suggests that clusters with a global scope and a high degree of knowledge integration show higher growth rates, more rapid adaption to changes, and overall a more sustainable financial performance (*shown in figure below*) (Morosini, 2004).

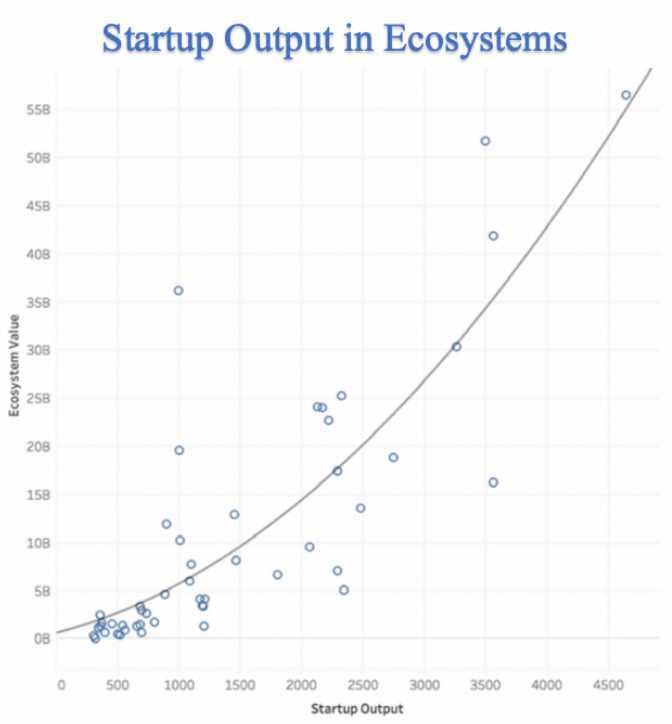


Source: *Morosini, P. (2004). Industrial Clusters, Knowledge Integration and Performance. World Development, 32(2), 305-326.*

The strength of a cooperative industry cluster is the potential for combining innovation capabilities and approaching innovation as a collective, thereby increasing the efficiency in all steps of Hargadon & Sutton's

(2000) knowledge-brokering cycle creating an 'innovation factory' on a cluster level, rather than on a firm level. If an industry agglomerates in an area with the purpose of cooperating in innovation, it could set them dramatically apart from distant rivals and give them an edge in the competition against other cluster of the industry.

Since innovation is largely a social process (Gertler, 2003), an industry cluster with a great social community should be the perfect environment with its heavy flows of tacit knowledge through local worker mobility, common culture, and frequent interfirm knowledge interactions (Morosini, 2004). In theory, a clustered industry with a cooperative focus and a strong 'common glue' should create the sort of homogeneity and a knowledge flow amongst firms that could lead to an extremely innovation-intensive environment that benefits all participants in the long run.



Source: Startup Genome. (2020). *The Global Startup Ecosystem Report*

Engaging in cooperation that increases the value of the overall cluster also improves the sustainability of the cluster. As the graph on the left shows, if a cluster is well functioning and creates value for its members, new entrants to the industry in the form of startups will perform better and be more valuable to the cluster because they can participate rather than just draw from the common pool of knowledge and value (Startup Genome, 2020). In this way, the industry cluster gets continued knowledge renewal and novel approaches to established ideas.

It is generally agreed upon that firms can improve their ability to innovate through cooperative activities where resources are coordinated, and synergies are explored (Sampson, 2007). Since many regard knowledge as the main driver of innovation (Gertler, 2003), the coordination of cooperative activities that facilitate knowledge sharing and knowledge-creation among participating firms is a particularly important element in mutually beneficial innovation alliances (Sampson, 2007). Some of the most significant knowledge flows that improve innovation come from collaboration between enterprises and from the more informal interactions (OECD, 1997).

In Silicon Valley, tech firms have found out that clear channels for knowledge transfer and networks of mutual innovation has been beneficial for all parts of their industry and helped it grow. Silicon Valley is an industry

cluster where the sort of cooperative activity described in this thesis can be observed. The cluster has steadily been growing and is still sprawling out as new firms establish themselves in the cluster in search for this cooperative environment. The Silicon Valley cluster is a perfect example of an industry cluster that goes beyond what can be explained by traditional cluster theory. These clusters of cooperative competition where direct competitors join in mutually beneficial innovation practices and knowledge sharing are also known as 'Innovation Hubs'.

The term 'Innovation Hub' is defined in various ways throughout scientific literature. These different definitions all have some similarities though. Most of them describe a society of different, somewhat interrelated entities locating in close proximity with a goal to collaboratively innovate and enhance the current offerings of the industry. Other terms such as 'Knowledge Hub' and 'Education Hub' are also sometimes used instead to cover this description. This thesis will use the term 'Innovation Hub' when an industry motivated by the possibilities of mutual innovation has clustered, focusing on collaboration and open channels of intended knowledge transfers.

7. Silicon Valley – a Hub of Innovation

The small region located in one of San Francisco's many valleys has the true name of Santa Clara Valley. In the 1970's, the term 'Silicon Valley' started being used about this place because of the agglomeration of the electronics industry and the tech industry that lead to several innovations, one of which was the silicon-based integrated circuit which dramatically enhanced the performance of computers. Today, Silicon Valley has evolved into the premier cluster of the high-tech industry with immense innovative capability (*as the table to the right shows*) and huge economic capacity (Silicon Valley Leadership Group, 2020).

The Global Startup Ecosystem Ranking
Top 25 Regions*, 2017-2019

Global Innovation Region	2019 Ranking	Change from 2017
Silicon Valley	**1st**	**No Change**
New York City	2nd	No Change
London	Tied for 3rd	No Change
Beijing	Tied for 3rd	Moved up from #5
Boston	5th	No Change
Tel Aviv	Tied for 6th	No Change
Los Angeles	Tied for 6th	Moved up from #10
Shanghai	8th	No Change
Paris	9th	Moved up from #11
Berlin	10th	Moved down from #7
Stockholm	11th	Moved up from #14
Seattle	12th	Moved down from #10
Toronto-Waterloo	13th	Moved up from #16
Singapore	14th	Moved down from #12
Amsterdam	15th	Moved up from #19
Austin	16th	Moved down from #13
Chicago	17th	Moved up from #18
Bangalore	18th	Moved up from #20
Washington D.C.	19th	New in top 25
San Diego	20th	New in top 25
Denver-Boulder	21st	New in top 25
Lausanne-Bern-Geneva	22nd	New in top 25
Sydney	23rd	Moved down from #17
Vancouver	24th	Moved down from #15
Hong Kong	25th	New in top 25

Source: Startup Genome. (2020). *The Global Startup Ecosystem Report*

7.1 The Story

Santa Clara Valley was not an obvious location for any company, but that did not stop William Shockley from establishing Shockley Semiconductor in the region in 1956 (Rosenberg, 2017). Despite many other and probably better choices, such as the Boston area where MIT was developing technology related to the conductor industry, Shockley was raised and educated in California and wanted to stay there (Kenney & Patton, 2007). The decision to establish a company in a place without natural advantages was boiled down to one of many thoughtless decisions made by bad management and as such the company did go under sometime later (Rosenberg, 2017).

During the worst time of the company, Shockley Semiconductors started to experience mass resignations and many of the former Shockley employees contributed to the sprawling of new startup businesses in the area (Kenney & Patton, 2007). This transformed the region into a hub of innovative thinking and soon the silicon-based computer chip. The region was named after this invention by a journalist in 1973 and Silicon Valley was born (Rosenberg, 2017). The silicon-based conductor was one of the most disruptive innovations of the late twentieth century as it enabled immense possibilities for digitalization and computer technology (Kenney & Patton, 2007).

A social supportive community soon started developing around the cluster, and also the Provost of Stanford University saw Silicon Valley as the perfect partner in developing the school's electrical engineering based on the MIT model. Later, the company Xerox established its West Coast research facility there, and now Silicon Valley had well-educated workers coming out of Stanford and a research facility that in combination with the university gave firms access to a skilled worker pool (Kenney & Patton, 2007).

The area now provided some actual business reasons for tech companies to locate there. This meant increased amounts of startups and venture capitalists started taking notice. The industry cluster was now flourishing with skilled individuals and incoming money flow to support their activities (Kenney & Patton, 2007).

7.2 Silicon Valley Today

The cluster firms and internal support system continued evolving together and today Silicon Valley acts as the prime example of a prosperous industry cluster. The modern Silicon Valley has become a cluster mainly for software companies, like Google and Facebook, leaving its history of manufacturing components and instruments for computers and communication equipment (Kenney & Patton, 2007).

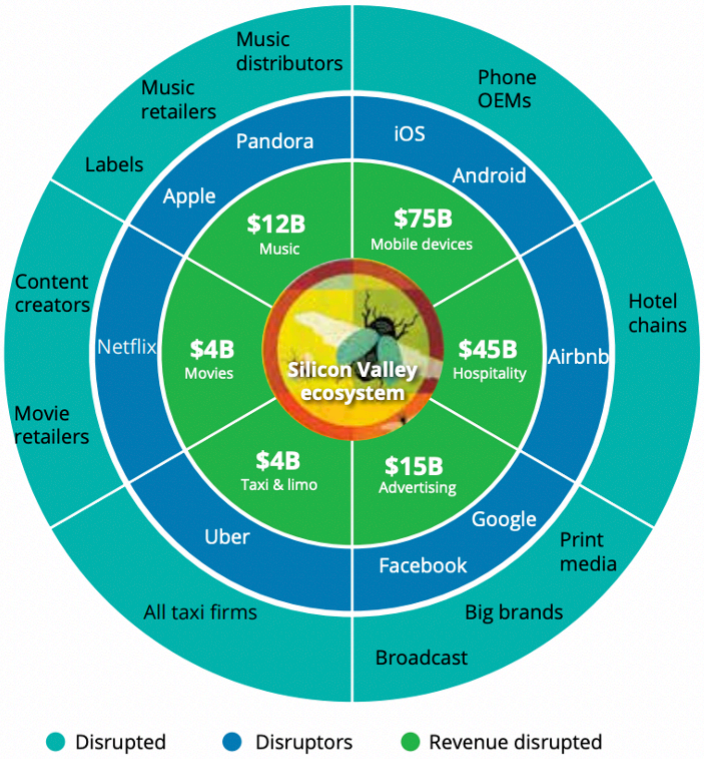
The tech cluster has grown geographically, expanding to other counties in the southern California area where local support exists. Broadly speaking, the entire San Francisco area has been very supportive of the tech industry, contributing to the cluster growing and now covering an area of 4,800 km^2, with a population of 3.1 million people, and employing more than 1.7 million people (SVIRS, 2020).

Silicon Valley receives a constant flow of new tech talent from Stanford University, UC Berkeley, and USCF, which holds an important supportive role in the success of the cluster (Startup Genome, 2020). CBRE (2020) defines tech talent as individuals educated and employed in software developing/programming, database and systems operations, technology engineering, and computer and information systems.

By CBRE (2020) measures, Silicon Valley has a tech talent pool of 380,000 specialized workers far ahead of any other tech market with the next largest having around 270,000. Over the last 5 years, Silicon Valley has created almost 90,000 new tech jobs, but only educated 37,000 specialized tech workers (CBRE, 2020). This means that the cluster relies on talent migrating from elsewhere.

Silicon Valley is the clearest example of being the innovation hub of an industry as most new ideas and concepts in tech gets born within the California based cluster (Deloitte, 2016). From 2000 to 2015, the patent registrations coming out of the Santa Clara area in California has tripled, and every year twice as many patents are registered from that area than anywhere else in the US (USPTO, 2015).

It is not a coincidence that many of the largest disruptive innovations come from Silicon Valley based companies. Within the borders of the Silicon Valley cluster, ideas and knowledge flow freely and effectively, leading to disruptive thinking that makes old established concepts seem obsolete. From the figure to the right, it is clear how Silicon Valley firms have forced industries to rethink their entire foundation. Netflix entered the movies and television industry and completely disrupted that market. Airbnb rethought the established idea that travel and hotels went hand in hand, and Apple completely disrupted the meaning of a mobile phone. But what is it that makes this industry cluster in the Bay Area of Southern California able to have such a significant impact on the major industries of the modern global world?



Source: Deloitte. (2016). *How to innovate the Silicon Valley way: Tapping into the Silicon Valley innovation ecosystem.*

7.3 What Makes the Silicon Valley Industry Cluster Special?

Importantly, when using the Silicon Valley cluster as the prime example of what the ultimate industry cluster is and as the Olympus all industries should strive to create their own version of, some precaution has to be made.

Silicon Valley is a cluster of the tech industry or the information/computer/electronics (ICE) industry, which historically has been more susceptible to disruptive innovation and periods with low entry barriers (Kenney & Patton, 2007). As the information technology industry has grown incredibly big and now dominates the scene in Silicon Valley, entry barriers are lower than ever, since entering that market does not require large investments in equipment and property, but rather good coding skills and server space. All this is to say that the Silicon Valley success story is not fully representative of how the journey towards an innovation hub would look for a more classic consolidated industry, but it can still teach us a lot about the prerequisites for

establishing such a cooperative environment with valuable output. We can also learn a lot about how the industry integrates the support infrastructure that exists in the cluster and how those two co-evolve and create that strong 'common glue'.

To understand how Silicon Valley avoids its members acting in self-interest, competing intensely for depleting resources, we should look into its socially and professionally interlinked community and how that creates a shared interest that promotes cooperation amongst its members. In Silicon Valley, a huge community pool of expertise has been built up through the years and is continuously replenished through knowledge sharing activities between agents of the cluster (Leonard & Swap, 2000).

Cooperation and a Collective Mindset

A typical cooperation between competitors in Silicon Valley happens between large established companies and startups entering the industry. This types of collaborations often start symbiotic as sort of a mentoring partnership where the large company is interested in the potential of the startup as an acquisition target and the startup is interested in the growth involved with the investments and integration offered by the large company (Silicon Valley Bank, 2020).

Another way, we see partnerships between established Silicon Valley firms and new entrants, is when large corporations from outside the cluster establish an innovation branch inside Silicon Valley to tap into the knowledge-intensive innovative environment (Deloitte, 2016). Open innovation means exploiting external forces and corporations have found different ways of using this to enter and integrate themselves in the Silicon Valley ecosystem. It can be done simply by establishing an office in the industry cluster, a so-called 'corporate accelerator' where Silicon Valley talent is brought in to work on innovative solutions for the company (Deloitte, 2016). This is often done in collaboration with a Silicon Valley firm specialized in setting up and running these accelerators (Deloitte, 2016).

Corporations also make use of acquisitions, which allows them to takeover a company already present in the cluster and access the environment by those means. A path in between those two examples is when corporations from the outside enter Silicon Valley's venture capitalist market by investing in startups inside the cluster. This gives the corporation influence and possibility of patenting new tech or selling their share for profit later (Deloitte, 2016). All in all, many ways to tap into the innovation hub exist and the interest from outside is enormous.

A typical partnership in Silicon Valley is these collaborative agreements between a local tech company and an outside corporation with an innovation branch in the cluster (Deloitte, 2016). An example of this is the partnership between Apple and BMW, where Apple helps BMW integrate tech in their vehicles and BMW provides expertise in Apple's mission to create the iCar (Taylor & Love, 2015). This type of cooperation is often

based on licensing, a project, or a joint investment and can be either short-term project-specific or long-term bets on a larger scale (Deloitte, 2016).

Silicon Valley's innovative success is built on the idea that forging partnerships and cooperation across sectors of the industry and between competitors benefits all members (Silicon Valley Leadership Group, 2020). The adoption of open innovation allows Silicon Valley companies to tap into the abundant knowledge pool of the collective cluster (Deloitte, 2016).

The cooperation between competitors is what sets Silicon Valley apart from other clusters. "A hypercompetitive yet collaborative culture that celebrates both risk and failure" is how Deloitte (2016) describes the unique internal environment of the California tech cluster. All agents of the cluster share the common interest that they wish for Silicon Valley to flourish as the hub of innovation it is.

Plenty of examples exist, showing competing firms cooperating on projects that help move the entire industry forward and keep Silicon Valley on the forefront of innovation. In 2018, Google, Microsoft, Facebook, and Twitter, companies who seemingly overlap in many markets, joined forces and initiated a project to promote universal data portability, meaning that data and files should be able to exist on all platforms in all formats without having to download and re-upload and so on (Willard & Fair, 2018). The companies came together, bringing expertise from their own versions of this concept (Dropbox, Google Drive, OneDrive, Box), which have been and still is competing against each other for user traffic, to develop the ultimate solution to this issue affecting their industry (Willard & Fair, 2018).

Another recent example is from last year when Amazon announced their cooperation with more than 30 other Silicon Valley companies, including Microsoft, Sonos, Spotify, and Verizon, forming the Voice Interoperability Initiative with the goal to develop voice-controlled operating systems (Fisher, 2019). More importantly, this collaboration was forged to influence customer behavior towards products that support multiple voice services, in order to force manufacturers to design their products in that way (Bohn, 2019). Giving the consumer the possibility to select between several voice services and to use the one that best support their particular situation at a specific moment, means that the tech companies developing these systems will have a market that did not exist before (Fisher, 2019). One thing was the collaboration on developing a concept which those companies were competing on, but another was the power they gained as a united voice to push the collective industry forward.

One thing is to pull your weight for the good of the collective, but many of the largest firms in the cluster go beyond that as an average of $200 million are philanthropically provided annually by the corporations to the local area to be invested in education, healthcare, culture, recreation, social services, and more (SVIRS, 2020).

Worker Mobility

Because Silicon Valley contains most of the world's top tech companies, workers in the cluster never have to look far for job opportunities (CBRE, 2020). A common phrase referring to Silicon Valley's immense internal job market is that "In the Valley you can change your job without changing your parking spot." (Leonard & Swap, 2000). The mobility of workers is very high in Silicon Valley (Leonard & Swap, 2000) as is often the case in clusters (Morosini, 2004). It is not only between firms that a high degree of worker mobility is observed in Silicon Valley, it is fairly common that talent will leave firms to create their own startups usually within the boundaries of the cluster (Leonard & Swap, 2000).

In Silicon Valley, there is a high rate of new entrants on the market and a significant part of the institutional network is set up to support this emergence of startups. Instead of viewing it as an industry threat, Silicon Valley has integrated a low barrier of entry as part of the cluster DNA, with many of the established companies actually being the source of these entrepreneurs (Gompers *et al.*, 2005). Developing a continuous stream of cluster-educated individuals who are employed by cluster firms to then finally creating their own startup with the support from the cluster, ensures that the collective identity is sustained and renewed. Many of the most successful tech companies, such as Google and Yahoo!, have been created by Silicon Valley educated people, who then collaborated with Silicon Valley institutions like local universities or corporate research labs to develop their own startup (Kenney & Patton, 2007).

Work Culture

Silicon Valley has a pioneering culture in many ways and the way they design the workplace and work environment is no different. The culture in Silicon Valley is one that seeks to blur the lines between work and private life and instead explore ways of creating work-life integration (Pardes, 2020). On-site services like hairdressers and masseurs are fairly normal in the 21st century workplace, but in Silicon Valley the on-site services include everything from acupuncture to nap pods to free dinner in the evening (Pardes, 2020). The policy on vacation and days off is very lenient and when at work, table-tennis, foosball, and pool tables are just some of the features in the many common rooms and activity rooms to make having a job feel less like a duty and more like a lifestyle.

The clearest example of how a Silicon Valley workplace differs from an ordinary one is the Google corporate headquarters or 'Googleplex'. With its 17 hectare and an additional 24-hectare site under construction (Colliers International, 2020), it is built more as a college campus or even a small town, than as a corporate office. The dedicated office space accounts for about 300,000 square meters (Colliers International, 2020) and features many typical Silicon Valley characteristics. The Googleplex has ball pits to jump around in and the different

floor levels of the office building are not only connected by stairs or elevator, but have slides going through the building that the employees can ride down to a different floor (Ashton & Giddings, 2018).

Overall, the goal is to maximize the openness and contact between people of all ranks. Hierarchies are flattened by replacing corner offices with open floor plans and free seating combined with the limited use of job titles (Pardes, 2020). Everyone should be able to interact with everyone, work should feel like home, and coworkers should be more like family and friends.

Institutional Support Network

In Silicon Valley, the supportive ecosystem around the firms operating in the cluster has formed over time along with the industry cluster itself and is now made up by a large number of independent organizations with different capabilities providing help in various ways (Lee, 2001). Compared to other industry clusters, Silicon Valley universities and government-owned labs spend more resources on research and development (Silicon Valley Leadership Group, 2015). Additionally, companies and institutions often have research and development activities in Silicon Valley, which means that the cluster is sprawling with research, development, and design centers of various size and scope (Silicon Valley Leadership Group, 2015).

In terms of initiating, managing, and participating in cooperation that benefits the collective Silicon Valley ecosystem, institutions play a key role (Squazzoni, 2009). Several organizations have formed in Silicon Valley with the purpose of promoting cooperative behavior, knowledge sharing, and overall ensuring the continuous renewal of the industry clusters capabilities and ability to lead the global world in innovation (Squazzoni, 2009). Joint Venture: Silicon Valley Network and Silicon Valley Leadership Group are some of the largest of these institutions fighting for the good of the cluster. What is special about these two organizations is that they are created and managed by or in collaboration with top leaders from many of the largest and most successful Silicon Valley companies (Squazzoni, 2009). Bringing industry leaders together like this cements these organizations as strong figureheads of the cluster culture and identity, further strengthening the foundation of cooperation and collective innovation that benefits the entire cluster.

Leadership

Establishing a ‘common glue’ is an integral part of creating an industry cluster rich on cooperation and mutual growth (Morosini, 2004). In order to build a strong ‘glue’, one of the five capabilities that a cluster needs to attain according to Morosini (2004) is leadership. In Silicon Valley, leading firms in the tech industry continuously scout for talent in this regard (Leonard & Swap, 2000). The leaders of these top companies engage in mentoring and spend time coaching and grooming new leaders who can continue the successfulness of the

industry cluster. Current leaders even help the leaders of tomorrow to become appointed in senior positions of competing firms if it helps move the cluster along mutually rewarding path (Leonard & Swap, 2000).

In Silicon Valley, an important part of the cluster's fabric is the continuous loop of learning through mentoring. The tech industry cluster in California has a unique degree of mentorship as part of its 'common glue'. The leaders even at the absolute top levels traditionally take on proteges in the form of young talented entrepreneurial minds and groom them to be the leaders of the next generation's Silicon Valley (Leonard & Swap, 2000). Where venture capitalists support new entrepreneurial endeavors with financial resources, these so-called 'mentor capitalists' support through their specific cluster related knowledge. They help newcomers networking inside the cluster, understanding the code of behavior and culture of the cluster, and generally prepare them to take over the cluster leadership role (Leonard & Swap, 2000).

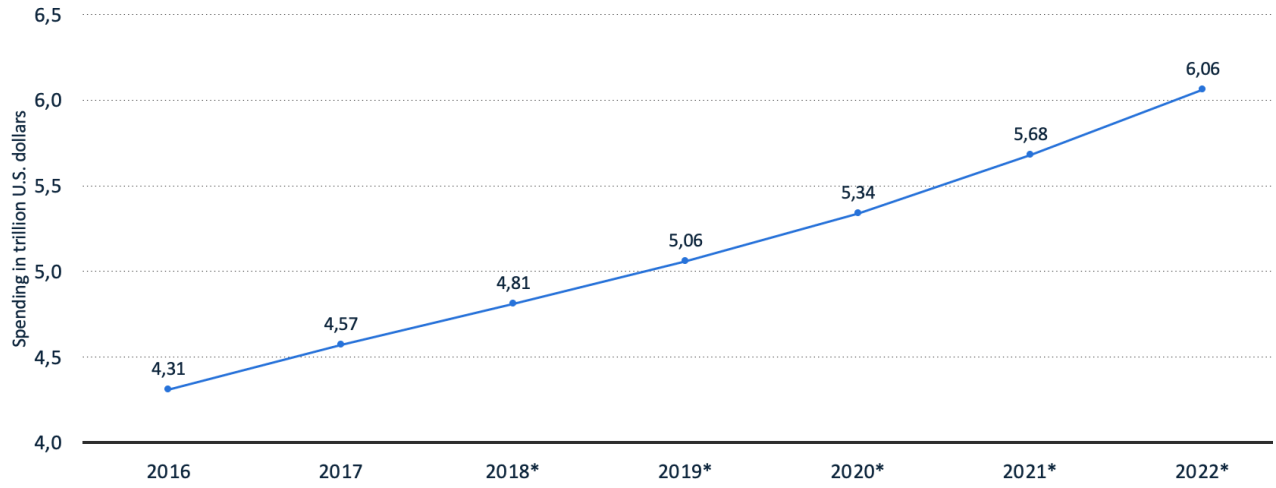
The commonness and social community that Silicon Valley has succeeded in creating, makes experienced leaders eager to stay active inside the cluster even when they desire to scale back their work life. Therefore, we see many of these CEOs and former CEOs transition to 'mentor capitalist' when they lose interest in the 24/7 CEO lifestyle, but still love maneuvering the cluster's inner workings (Leonard & Swap, 2000). The feeling of common identity that the Silicon Valley cluster creates amongst its members motivates mentoring and gives the desire to share hard-earned experiential knowledge, because even when no longer a part of the industry it feels like they have a stake in its activity and performance (Leonard & Swap, 2000). That of course extends to current leaders as well, with the majority of executives in Silicon Valley stating that they are actively committed to the cluster's success and to expanding its presence and employee count (Silicon Valley Leadership Group, 2020).

Venture Capital

Silicon Valley has performed impressively in terms of growth and financial strength in recent years. Huge sums of money flow into the cluster from outside to a degree where we now see tech companies be the most valuable in the world and the tech industry itself growing to be one of the largest, as shown in the graph below.

Silicon Valley has a reputation for producing knowledge and sharing that knowledge within the cluster and that attracts strong investors. Key to the clusters large cash inflow is that investors find it possible to capture or harvest some of the value that is created within. The value is created from the sharing of tacit knowledge which is difficult to extract and therefore investors cannot really exploit the cluster for value, but rather have to engage with it as venture capitalists ultimately adding to the shared value instead of extracting from it (Gertler, 2003).

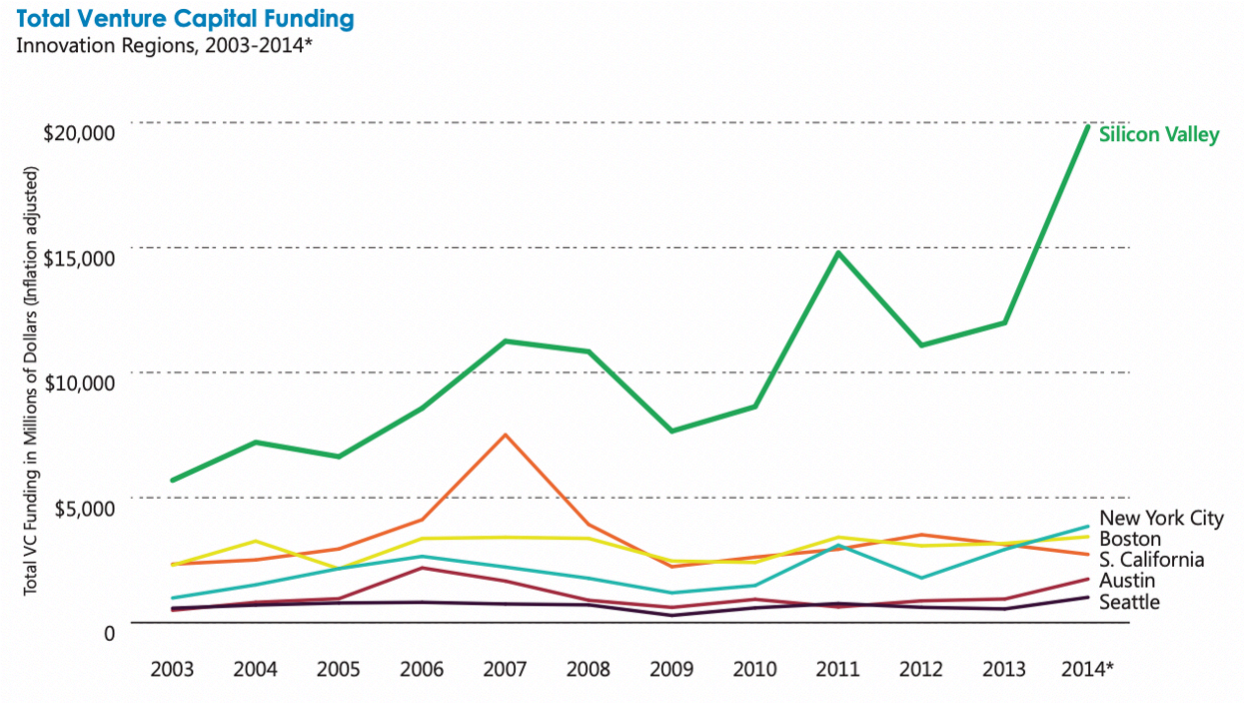
Total information communication technology (ICT) market spending worldwide from 2016 to 2022 (in trillion U.S. dollars)



Source: Statista. (2018). *Total information communication technology (ICT) market spending worldwide from 2016 to 2022.*

The investor capital scene in Silicon Valley is heavily influenced by the startup culture that rules within the cluster (Silicon Valley Leadership Group, 2015). Where capitalists traditionally focus on establishing, then managing and controlling parts of firms to gain continuous cash inflow, venture capitalists in Silicon Valley work from an establish, grow, and then sell for a large payout mindset. This approach has successfully secured many VC's with large capital gains which naturally inspires even more VC's to join the Silicon Valley scene (Kenney & Patton, 2007).

The rich VC support infrastructure (*as seen in the graph below*) provides Silicon Valley with a great advantage as this overflow of available capital means that entrepreneurs are able to get a larger variety of ideas and projects funded (Silicon Valley Leadership Group, 2020). The investors know that chances of getting it right are larger in Silicon Valley than many other places and since tech can be applied to most fields, it is tough for investors to prematurely dismiss an investment opportunity and deem it unlikely to succeed. The investment network is one of the supportive systems that helps an industry cluster to succeed and in Silicon Valley this system is loaded with capital and therefore a collectively high risk tolerance because, as Kenney & Patton (2007, p. 58) puts it: "if these investments fail … only a relatively small proportion of the total VC resources and, perhaps, a few venture capitalists will be lost.".



Source: Silicon Valley Leadership Group. (2015). *Silicon Valley Competitiveness and Innovation Project*

8. Building an Innovation Hub

Ideas are one of the most valuable resources for a business today and without a continuous inflow of this modern currency, no company will survive long-term. A clustered industry represents huge potential for idea creation as established by this thesis. It could be argued that transitioning from an industry cluster to an innovation hub with immense capabilities for idea creation is something every company should strive to be a part of. Luckily, as stated by Hargadon & Sutton (2000):

> "it has everything to do with organization and attitude, and very little to do with nurturing solitary genius." (p. 157)

In other words, any company in a clustered industry could adopt a cooperative attitude and organizing in a way that allows them to engage in knowledge sharing and productive activities with other members of the cluster.

Based on previously analyzed theory of clusters, knowledge and innovation with inspiration from the case of Silicon Valley, this chapter will seek to isolate and discuss the driving factors in establishing an innovation hub that provides members with a long-term sustainable competitive advantage against distant rival companies and other clusters of the industry.

8.1 ESTABLISHING THE INNOVATION HUB

The following concepts are the pillars on which an industry cluster has to build its transformation into a hub of innovation. They are based on learnings from theory described in earlier chapters and on the real-world case of Silicon Valley.

TRUST

Establishing trust is key to any cooperative activity where parties rely on each other and therefore expect one another to put in their fair share of effort. The reason firms often hesitate when considering cooperation is the unknown variable of the opposite parties' behavior. There is no sure way of knowing which actions another firm will take after the partnership has been agreed upon.

In joint innovation, some of the more prevalent issues that can arise are free-riding and opportunism where one of the parties tries to take advantage of the other. Additionally, knowledge-diffusion where knowledge is unintendedly shared is a risk factor of engaging in cooperation with rivals. Overall, the monitoring costs endured to try and avoid these issues is in itself a significant hurdle to engaging in cooperation with competitors (Tomlinson & Fai, 2013).

Tomlinson & Fai (2013) concluded that the main issue in facilitating knowledge sharing between firms is the difficulties in nurturing the relationship necessary for achieving a mutually beneficial outcome. Unless supported by governments and/or trade associations, companies usually end up having to invest a lot of time and resources into not only managing the partnership, but also initially into the search for a possible partner (Tomlinson & Fai, 2013).

Trust is clearly paramount to establishing the kind of cooperative relationship that leads to tacit knowledge sharing and greater innovative capabilities, but for this kind of knowledge sharing to be effective, the parties must first share similar basis of explicit knowledge. Gertler (2003) states that trust also has to be established before important explicit/codified knowledge can be shared, because this sort of knowledge is at high risk of imitation from competitors. Since explicit knowledge is tangible and not integrated in an organizational specific asset like an individual or a process, it is easier for someone outside the partnership to gain value from it. When sharing explicit knowledge, parties have to actively surrender some of their internal not widely available knowledge to the counterparty, trusting that they do not act opportunistically and that it will not get circulated to anyone outside the partnership (Gertler, 2003).

Eliminating geographical distance as a barrier is a great first step towards building trust and clustering naturally accomplishes this. The close agglomeration of the absolute top companies also means that the best deals and trade value often exists within the cluster promoting frequent interactions between members of the cluster,

which establishes relationships and lays the foundation for cooperative activities (Alcácer & Chung, 2007). However, just being located in close proximity is not enough to create a cooperative environment, firms need to actively establish a base of trust amongst each other. If firms share strong close cooperative ties, they are more likely to engage in resource pooling and development alliances which in the end improves the worth of innovations sprawling from the collective project (Tomlinson & Fai, 2013).

Since an innovation hub, as mentioned, requires all parties to engage in a greater cooperative environment, trust has to be established as a pillar of the industry cluster. From Morosini (2004) we know that having a common code of behavior among the members of the cluster leads to an environment where trust is more easily established.

This common code of behavior becomes naturally established in a cooperative cluster as the greater cluster network holds parties accountable for their actions. In a cooperative cluster, members will engage more with each other and information flows accordingly. "Firms will search locally first, for reasons well justified in economic terms." (Gertler, 2003, p. 85). Therefore, if a cluster is well-established, members will rarely have to look beyond the cluster borders for partnerships, which leads to frequent interaction across the different levels of the industry. Since a cooperative cluster is a complete industry gathered in close proximity, it is rich on various degrees of formal and informal interactions, making word-of-mouth a big factor.

As a company, your ability to engage in the rewarding cooperative activities provided by a cooperative cluster environment depends heavily on your local reputation. The word-of-mouth information sharing means that broadly speaking every company has knowledge of the other local companies' capabilities and activities (Gertler, 2003). This means that a company breaking the code of behavior in inter-cluster partnerships and such will become common knowledge across all levels of the industry and damage that company's reputation, making it difficult to engage in cluster activities in the future. The fact that bad behavior will most likely lead to this public blacklisting means that cluster members will naturally trust each other more as behaving opportunistically has significant consequences.

The local network and inter-cluster cooperation possibilities lead to local reputation becoming a very important asset as many details about the partnership process becomes part of the clusters word-of-mouth knowledge (Gertler, 2003). The transparency that comes from this deter firms from opportunistic behavior and encourages respectful approaches to other firms' knowledge when they engage in sharing-activities (Gertler, 2003). In this way, clustering eliminates another barrier to cooperation by creating trust between potential business partners, because partnerships become transparent inside a cooperative cluster.

TALENT CREATION

Establishing inter-firm cooperation and knowledge sharing matters very little if knowledge does not exist or new knowledge is not created. Tacit knowledge leads to innovation (Gertler, 2003), but tacit knowledge is mostly knowledge created by people through experience. Essential to creating this type of knowledge is that the workers are well-educated in industry-specific matters that allow them to process, analyze and create their own tacit knowledge (Silicon Valley Leadership Group, 2020). Companies in an industry cluster should strive to invest in the human capital inside the cluster through education and training (Gertler, 2003).

If a cluster wants to be a hub of innovation, new workers should be well-educated to a degree where they are able to not only sustain the knowledge pool, but also add to it with their own tacit knowledge, ensuring that the collective knowledge is continuously renewed. Acquiring new talent from the worker pool should mean that you also acquire new tacit knowledge embodied in them (Nonaka *et al.*, 2000).

The issue here is that tacit knowledge is difficult to transfer without it involving close collaboration and frequent interactions, which makes it important for an industry cluster to figure out how to move tacit knowledge created and collected in the context of interfirm collaborations to the context of educating new workers. Obviously, the same rules apply here; tacit knowledge sharing requires interactions between the sharer and the absorber, but it is important also to remember that explicit knowledge is necessary to create tacit knowledge (Howells, 2002). Therefore, education of the future workforce should find the right balance between theoretical learning from which explicit knowledge is gained and practical learning where the education system interacts with the business world, which is where tacit knowledge is gained (Gertler, 2003).

Malmberg and Maskell (2002) further solidifies the importance of establishing a base of explicit knowledge among the cluster workforce, stating that the explanation to why innovation can flourish in closely concentrated environments like clusters is that they provide many local opportunities to share and monitor explicit knowledge. The argument is that if every individual can quickly and uniformly be exposed to as much codified or explicit knowledge as possible, they are better able to create and engage with tacit knowledge.

In Silicon Valley, the worker pool is skilled with more than 50% of adults having at least a bachelor's degree compared to the US average of 33% (SVIRS, 2020) and over 70 percent of the cluster's companies reporting access to skilled labor as major strength of the region (Silicon Valley Leadership Group, 2015). A large part of Silicon Valley's success is the international immigration of skilled individuals with great educational background (Silicon Valley Leadership Group, 2015).

Silicon Valley does rely on talent migration because their local education system is not on scale with the size of the cluster (SVIRS, 2020). The support is there from the broader San Francisco area and the local top university Stanford, but it has probably just been impossible to upscale education to a degree matching the

exponentially fast growth experienced by the tech industry clustered in Silicon Valley. No matter the cause, the cluster's lack of talent creation is indeed a weakness and cause for concern. As other tech clusters pop up around the world and in the US especially, Silicon Valley's net migration falls and in the last few years more people have left the cluster than have joined (Silicon Valley Leadership Group, 2020). If the trend continues and skilled, well-educated tech workers stop migrating to Silicon Valley, the cluster will lose much of its strength and advantages in the competition against other tech clusters. This weak position, Silicon Valley finds itself in, further emphasizes the importance of establishing strong talent creating capabilities in an industry cluster wanting to emerge as a hub of innovation.

Stanford University plays an important role in creating talent for the Silicon Valley cluster and is an essential facilitator of the cluster's innovative capabilities. The university is among the supportive institutions that invest the most in the tech industry with innovative research and a constant flow of new skilled labor for the clustered firms (CBRE, 2020). A 2012 study found that if a country was made up solely by Stanford educated entrepreneurs, it would be amongst the 10 largest world economies (Fu & Hsia, 2014). Locating the cluster in an area with excellent universities and engaging in cooperation to integrate it into the cluster network is how Silicon Valley creates talent. Becoming a hub of innovation requires a first-class university as supplier of specialized talent for the specific cluster (Fu & Hsia, 2014).

Talent Retention

One thing is to create tacit knowledge, but an industry cluster also needs to succeed in retaining the talent that embodies this tacit knowledge in order to sustain its role as an innovation hub. Talented labor is potentially highly mobile (Florida, 2002) and therefore retaining it as well as attracting it from elsewhere is key to the innovative capabilities of an industry cluster.

An innovation hub, as defined by this thesis, will spend many resources on talent creation and therefore retaining the talent inside the cluster becomes paramount. As described earlier, industry clusters have high degrees of inter-cluster worker mobility because of the amount and variety of job opportunities existing inside the local environment. This continuous migration is actually beneficial to the development of the innovation hub as a whole, since research suggests that firms who employ more individuals with experience from a wide range of companies will be successful more quickly than those who do not (Beckman *et al.*, 2007). In this way, the innovation hub grows as new local companies rise quicker than those outside the cluster, further enhancing their overall position in the global market.

That benefit of course depends on the ability to contain the migration inside the cluster avoiding the risk of losing the talent that so much was invested in developing. With mobility being such a large part of cluster culture, it will not be a big leap for an individual to leave their job if a better opportunity presents itself. It

therefore falls on the innovation hub to make sure that those better opportunities exist inside the cluster. An innovation hub needs to contain other factors in its cluster environment that help job opportunities inside the cluster seem better than those from distant rivals.

Florida (2002) explains that retaining and attracting talent is more of a social process where workers' 'quality of life' is key determinant for whether they seek elsewhere or not. A broad labor market that offers challenges and possibility for all levels of workers from newcomers to experienced veterans, as well as a social environment that embrace diverse talent, and a welcoming social system that has low barriers of entry are the factors that broadly represent the social character of a region that attracts and retains talent (Florida, 2002; Gertler, 2003).

In Silicon Valley, the unique work culture helps retain and attract workers with its goal of improving the overall experience of work and integrating work and private life. It is also heavily influenced by the startup culture and innovation focus that exists within the cluster (Ashton & Giddings, 2018). The initial intrigue and excitement of a different attitude and perspective on what it means to be 'at work' will wear off at some point (McAveeney, 2013). The crucial aspect making workplace culture a sustainable advantage that helps a cluster retaining and attracting talent is alignment with the overall culture of the cluster (McAveeney, 2013). Google succeeds with their integration of 'play' in the work culture because rather than just making space for it, they build their work practices and organizational culture around it (Ashton & Giddings, 2018).

An industry cluster will find it difficult to transform into a hub of innovative thinking unless it retains its creative talent, and aligning the overall cluster vision of innovation with a work culture that promotes and encourage innovative thought is key to harnessing the potential of knowledge workers and holding on to them (Henton & Held, 2013). Adopting a startup culture in large corporations with seemingly flat hierarchies and room for openness and interaction promotes knowledge sharing from all levels and improves the willingness to speak up with novel ideas (Ashton & Giddings, 2018). Informality invites people to be more creative, feeling heard and experience an opportunity to matter and influence – knowledge workers will be more likely to stay in this environment that supports entrepreneurial thinking and creativity compared to a structured hierarchical corporation (Ashton & Giddings, 2018). The open and flexible 'anytime, anywhere work' is the concept that the 'office of the future' should be built upon if the desire is innovation and knowledge sharing (Humphry, 2014).

Silicon Valley confirms the idea presented by Florida (2002) that a strong job market and a social community that is easy to get integrated in, matters a lot in terms of holding on to the talent. Worker mobility is high in clusters and Silicon Valley is no different. Silicon Valley has used the fact that a clustered industry is a tight-knit ecosystem to its advantage by integrating the social community into the work environment. The advantage

being that even when at work, employees engage with what is also the social network and therefore it is easier to become part of it.

MOTIVATION

We have established that an industry cluster needs to have an education system set up to also create new tacit knowledge and a social system set up to retain and attract tacit knowledge, but tacit knowledge exists within people and we cannot assume that people automatically and willingly share everything they know.

Silicon Valley has moved away from the old-fashioned 'carrot on a stick' controlled motivation, where money, recognition, and status coerces workers to perform their best for the company. This method of motivation has been linked with the sort of environment that hurts knowledge sharing because the rules of how to work and pressure to perform forced on employees through monitoring and evaluation keeps them from moving 'outside the box' and risk failing (Ryan & Deci, 2000).

Wanting to be a part of the cluster community and pulling your weight for the good of all member requires motivation; not the controlled motivation as described above, but autonomous motivation (Ryan & Deci, 2000). Autonomous motivation can be boiled down to 'liking what you are doing' and doing it not for a reward, but because you want to learn and get better (Ryan & Deci, 2000). Sharing of tacit knowledge requires the presence of this sort of intrinsic motivation (Reinholt *et al.*, 2011).

From the case of Silicon Valley, it can be argued that establishing and nurturing a common identity among cluster members is key to creating intrinsic motivation. Being a company or organization of Silicon Valley is synonymous with a cooperative spirit and innovative focus. On an individual level, this is transmitted throughout the cluster by the unique work culture, frequent interactions with other organizations, social events, and especially cultural leaders showing the way. It means something to be a part of Silicon Valley. An innovative culture fosters innovation, Silicon Valley proves that, and industries wanting to create a hub of innovation themselves should take notice. Knowledge sharing and openness should be ingrained throughout all levels of the cluster as an environment that supports and promotes knowledge sharing is key to motivating workers to engage (Foss *et al.*, 2015).

A specific lesson to learn from Silicon Valley relates to how they have been able to integrate private life and work life through flexibility and adding many features to the workplace that are not commonly associated with being 'at work'. It is not given that an individual's job and personal identity align but blurring the line between these two does help Silicon Valley create motivation to commit to their work, but also bring their job with them outside of the office where knowledge sharing also happens in a cluster like Silicon Valley (Foss & Stea, 2014).

When workers are intrinsically motivated, a great advantage of a clustered industry becomes the bubble it creates where the business network resembles the social network. Other than intrinsic motivation to share, having the opportunity and ability to share knowledge is also important for the overall motivation. The social network of an industry cluster like Silicon Valley is complex and provides many opportunities to share (Romanelli & Khessina, 2005). People from the different organizations who are all somehow related to the clustered industry mix outside of work because they are all located in the same area which continuously evolves the social environment over time (Beebe *et al.*, 2013). Many of these people are educated in the same way, having gone through similar educational programs which improves their ability to share knowledge as they have a similar frame of reference.

Being motivated to engage in the networks of the cluster and in knowledge sharing activities also comes from a common identity that binds people of the cluster together. Forming identity involves raising awareness about shared interests and collective action (Staber, 2010). Having key inter-cluster actors, whose reputation goes beyond the local region, can be strong facilitators in establishing and maintaining internal cohesion within the industry cluster (Beeb *et al.*, 2013). This point is backed by Morosini's (2004) argument that an instrumental part of a strong 'common glue' is the leadership.

An innovation hub needs to have explicit leaders whose role in embodying the common cluster identity is broadly accepted by all members. These leaders play an important role in promoting knowledge sharing, co-operation, and mutually beneficial activities, by leading with the greater good of the community in mind, representing the vision and values of the industry cluster (Morosini, 2004). Importantly, as we observe from Silicon Valley, leaders need to invest personal resources into identifying and coaching new leadership to ensure the sustainability of the cluster and that the common identity remains as a unifying factor (Leonard & Swap, 2000).

Open Innovation

For an agglomeration of related companies to not merely exist as a clustered industry but instead flourish as a hub of innovation, it needs to transition towards more open innovation. Opening up the innovation process creates inflows and outflows of knowledge that accelerates innovation and also expand the markets that might make use of the innovation (Chesbrough *et al.*, 2006).

The rise of innovation hubs can often be backtracked to the point where engaging in problem-solving became a social process of collecting pieces of knowledge available from different sources inside the environment (Garud & Karnøe, 2003). "The creation of new opportunities by a collective" is described by Garud & Karnøe (2003, p. 294) as a foundation for technological entrepreneurship and the innovative performance scales

upwards with the geographical proximity of the involved actors. This emphasis on distributed agency in limited distance speaks to the potential innovative capability of a cooperative cluster environment.

This was also the development Silicon Valley went through as it transitioned from a clustered industry to a hub of innovation. The main point was to promote the collective problem-solving as focal point of the cluster operations and values, rather than focusing on creating world-changing, industry-disrupting technology (Kenney & Patton, 2007). In time, those collective short-sighted responses to immediate industry problems will be less diffused and gradually evolve to be considered joint efforts to find innovative long-term solutions (Kenney & Patton, 2007).

The companies in the industry cluster should strive to have the place of innovation being both inside and outside of the company. Using open innovation increases the chance of getting the best or the right people involved, because you don't limit yourself to own internal resources but rather make innovation a community project that captures the talent from all over the cluster. Exchanging ideas beyond the company boundaries by importing and exporting knowledge between firms and institutions inside the cluster accelerates innovation and enhances the overall innovative power of the co-located industry as a whole (Woodward *et al.*, 2006).

Clusters are the perfect foundations for open innovation strategies as the most important reasons why a company should open up the innovation process are heavily featured in industry clusters. The availability and mobility of highly trained and specialized workers is key to the performance of open innovation projects (Chesbrough, 2003) and inside a cluster we observe this more than anywhere else. Additionally, venture capital and investors play an important role in initiating and carrying out open innovation projects, while specialized suppliers prove to be rewarding cooperative partners for companies wanting to open up their innovation process (Chesbrough, 2003). Both investors and suppliers are a strong presence in the supportive structure of an industry cluster further enforcing the fact that an industry cluster provides the perfect environment for open innovation.

In Silicon Valley, where open innovation is part of the culture, we can observe how opening up innovation leads to it reinforcing itself continuously as new entrants join the cluster to take part in the valuable knowledge exchange. Because the cluster is world-renowned for its innovative capabilities, many companies are attracted to the location with the idea that they can harness some of that innovation themselves, in sort of an indirect open innovation where just being located in the cluster provides benefits to innovation. The large global companies usually have innovation centers or R&D locations and 61% of companies with innovation centers have a presence in Silicon Valley (Solis, 2015).

As more and more of these large corporations set up locations in Silicon Valley, more people are attracted to the location and more knowledge will be present. In the cluster, knowledge flows constantly and open innovation can be very rewarding. Most companies with innovation centers in Silicon Valley explain that it

provides them with access and exposure to latest developments in tech (Solis, 2015). Open innovation involves using the outside as key ingredient in the internal innovation process and being present in the cluster helps with attracting outside expertise, because a large amount of the industries specialized individuals is based in that area (Solis, 2015). Based on the case of Silicon Valley, it should be concluded that a part of opening up the innovation process involves embracing new entrants in the knowledge sharing process.

This startup friendly environment has paved the way for the emergence of new fields within the tech industry such as biotech, nanotech, and superconducting (Kenney & Patton, 2007). This sort of 'blue-ocean' innovation, where new markets are created, helps the entire tech industry grow by creating new market shares instead of having firms compete intensely to capture market share from each other, and it is largely made possible by the Silicon Valley industry cluster. In this way, the venture capital scene enforces the entrepreneurial culture of the Silicon Valley cluster and helps promoting the fact that new entrants to the industry should not be viewed as a threat but as an opportunity for the larger established firms.

The example of cooperation between competitors from earlier where Google, Microsoft, Facebook, and Twitter joined forces is also an example of open innovation in Silicon Valley. Even though these four companies are some of the strongest in the tech industry, they know that the Silicon Valley environment is uniquely knowledge-intensive and not taking advantage of that would be a mistake. Open innovation is key in an innovation hub and that is why they publish their source code for the project online, making it available to anyone interested in developing on it themselves (Willard & Fair, 2018) adding to the collaboration with their own knowledge-base and perspective.

8.2 CREATING THE SUSTAINABLE ADVANTAGE

Above are the criteria that have to be met in order for a well-established, well-functioning industry cluster to transition into an innovation hub. This thesis has argued for the necessity of creating a cooperative environment within the cluster in order to remain competitive in the long run. The second part of becoming a successful innovation hub is to create the fabric that will provide the firms within the cluster with this sustainable competitive advantage against sole companies outside the cluster or other distant clusters of that industry.

As future competition could end up being cluster versus cluster rather than just firms competing against each other, it becomes important to understand how to create a cluster that outperform other clusters of the same industry. This thesis seeks to establish the idea that inter-cluster cooperation and knowledge sharing is the capabilities that allows an industry cluster to rise above the rest, while also creating the innovation capacity and capabilities that makes it possible to sustain this competitive advantage. An innovation hub is perfect for facilitating this collaborative knowledge-heavy environment that provides a competitive advantage for firms

located there which is very difficult to imitate for competitors. Even if another cluster of the same industry transitions into an innovation hub, it is unlikely to evolve in the exact same way.

An important part of building this ecosystem that can set a cluster apart from the rest is the localized intangible social assets. Gertler (2003) argues that the cluster environment around the industry is what makes its competitive advantage sustainable because it is rooted deeply in the specific cluster location:

> "Because such assets exhibit strong tendencies of path-dependent development, they may prove to be very difficult to emulate by would-be imitators in other regions, thereby preserving the initial advantage of 'first mover' regions." (p. 85)

The social and supportive capabilities present in the local environment can be distinctive to that region and therefore one of the factors that make this competitive advantage so difficult to imitate by distant clusters (Malmberg & Maskell, 1999). These vital social assets are created a level above the individual firms and exist between firms rather than within individual organizations (Leonard & Swap, 2000). In this way, even though no individual firm can fully control these assets, every firm located within the cluster can reap the benefits from them; benefits that are only available to firms inside the cluster region (Gertler, 2003).

INSTITUTIONS

A critical factor in creating social assets is the local institutional setup. The presence of knowledge-related institutions supports and improves the advantage from being located in the cluster. For a number of reasons, it seems unlikely that a partnership between distant parties can match the knowledge sharing efficiency between parties in geographical proximity. As mentioned earlier, when parties are closely located, as they are in industry clusters, knowledge sharing efficiency is increased in many ways. According to Gertler (2003), a large amount of these drivers increasing the effects of knowledge sharing are formed indirectly by the institutional macro-environment of the cluster.

The cultural differences that makes cooperation challenging are to some degree eliminated within a well-established cluster since individuals are linked through similar education, training, and social community leading to similarities in norms, practices, business-related behavior and attitude (Gertler, 2003). Gertler (2003) proposes that these differences only present as cultural, but in reality "can be linked to very concrete differences in the macro-institutional architectures." (p. 95). In this way, Gertler (2003) concludes the institutional network of a cluster to be a key factor in creating the environment that facilitates cooperation. Therefore, it should be a focus point of industry clusters seeking to become a hub of innovation and cooperation transcending competing clusters of the same industry.

The case of Silicon Valley shows us the importance of an institutional factor that is not thoroughly discussed in literature on industry clusters. The venture capital scene plays a hugely important role in facilitating the ecosystem that continuously renews the collective knowledge pool and adds to the entire cluster's innovation capabilities. In 2019 alone, Silicon Valley "generated $42 billion in venture capital, which was invested in a record 92 megadeals (more than $100 million each)." (SVIRS, 2020, p. 8). This cements a strong VC scene as an important ingredient in building a sustainable innovation hub that will evolve and grow to keep driving the innovation of the industry.

In terms of more recognized factors in a strong performing industry cluster, regional economics research finds that proximity to universities or other educational and research institutions is directly associated with growth of regional industries (Woodward *et al.*, 2006). We see this confirmed in Silicon Valley and throughout theory on industry clustering as this supportive network helps initiate, manage, and facilitate inter-cluster knowledge sharing. The final conclusion must be that the integrating and evolving the institutional network is paramount for any industry cluster to transcend into becoming an innovation hub.

COMMONNESS

Another key driver for the kind of knowledge sharing environment that gives its participant a sustainable competitive advantage is the existence of routines and shared practices established by the organizations within the cluster. Having a common approach to business and business-related activities shared among all members of the cluster promotes both knowledge production and sharing (Wenger, 2000). Gertler (2003, p. 86) defines these communities of common practices as "groups of workers informally bound together by shared experience, expertise, and commitment to a joint enterprise.".

Innovations hubs, as this thesis defines them, represent this sort of community of practice in that workers are usually educated in similar ways, firms have similar culture, and knowledge is shared through cooperative activities and open innovation. The commonness and shared culture enable a smooth flow of tacit knowledge through narrative devices (Denning, 2000) such as storytelling, gossip, and speeches because all members of the cluster share a somewhat similar frame of reference. In this way, knowledge always flows, and new tacit knowledge is always created even outside work hours from less formal communication such as talking at dinner, mingling at gatherings, or talks at conventions and other events.

Silicon Valley is known for its many venues through which interactions occur between individuals from all the different parts of the industry cluster. Information sharing is all over Silicon Valley and happens at different levels, formally or informally, planned or coincidental (Kenney & Patton, 2007), resulting in endless opportunities for combining ideas and creating new ideas (Hargadon, 2003).

From Hargadon & Sutton's (2000) theory on innovation, we know that promoting interaction between individuals is key to an organization's innovative output. If a cooperative industry cluster can be considered as a collective organization, promoting inter-cluster interactions should therefore increase the collective innovative capability of the cluster overall. Silicon Valley confirms this theory as part of the cluster's culture is promoting knowledge sharing between skilled individuals from different organizations.

Silicon Valley has numerous ways of promoting a culture of openness and free exchange of ideas between its agents, many of which the rest of the world tries to imitate today. On an internal level, it is done by designing office spaces to be open and encourage interaction and by eliminating the divide between work and personal life. On an external level, the identity of knowledge sharing and cooperation is promoted throughout the cluster, while frequent events allow for the interaction between individuals from all around the industry cluster.

Silicon Valley offices pioneered the office design that much of the corporate world ones mocked but now imitates. It is all about openness that almost force interactions while breaking down the barrier of hierarchy and closed doors. Silicon Valley promotes the openness and idea exchanging culture by blurring the lines between work and personal life. Blurring these lines results in increased amount of informal interactions between workers as aside from working together they also live their private life amongst each other. The casual attitude this brings to the workplace also increases the frequency of interactions as hierarchical boundaries are less apparent, people seem more available, and relationships are formed quicker between more people.

A cluster environment with a widespread commonness amongst its agents provides the opportunity to promote openness and knowledge-interactions on a much large scale. If knowledge sharing is happening in interactions throughout the cluster with similar commonness and trust as it would within an organization, the knowledge sharing will expand immensely not only increasing the frequency of these interactions, but also the variety of knowledge exposed in the interactions.

KNOWLEDGE LEADERS

Any clustered industry with the desire to flourish as a cooperative ecosystem rich on knowledge and joint innovation needs leaders to promote these activities. Leadership is the sort of social capital that can influence the collective actions of the cluster positively in various ways. In terms of creating other types of social capital, leadership initiates and maintains the inter-cluster relationship network, they represent the norms of reciprocity, cooperation, and commonness, and they provide broad access to otherwise limited knowledge (Squazzoni, 2009).

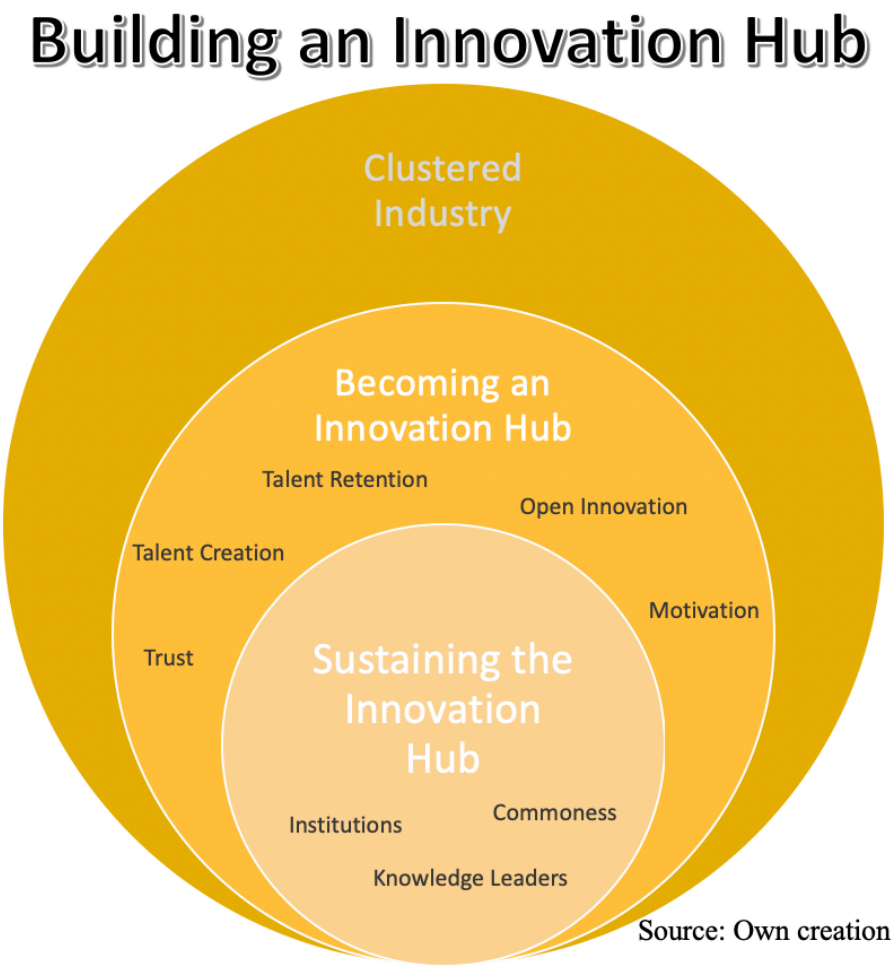
In terms of providing information to the wider cluster environment, leadership leads the integration of new connections or people into the cluster system and provide information on who is integrated and what issues they can help address (Squazzoni, 2009). Regarding issues, leadership establishes the priority of issues and

coordinates the efforts to address them (Squazzoni, 2009). An important leadership role in terms of coordination is to establish a history of cooperation and an understanding of who holds which capabilities in terms of problem-solving (Squazzoni, 2009). From Hargadon & Sutton's (2000) theory on innovation, we know that an important role in an innovation hub is to spread information on who knows what.

The cluster leadership also have an important role as mediator, monitor, and enforcer once cooperation is established. The leaders engage in cooperation ensuring that all parties understand overlapping interests and the trade-offs that make cooperation beneficial for all parties (Squazzoni, 2009). They need to be at the forefront in terms of expanding the idea of when cooperation is an option and make cooperation an almost automatic choice when conditions are favorable, and interests and preferences are aligned (Squazzoni, 2009).

Most importantly, leadership has to use its power as a trust builder by helping the transparency of cooperation. Their role as enforcer is essential in preserving the culture of shared collective interests by raising awareness when someone acts opportunistic in cooperative activities (Squazzoni, 2009). Making sure that bad behavior is punished helps create trust between the agents of the cluster.

In Silicon Valley, leadership has a strong impact and takes on great responsibility as this common identity, the cluster creates, often grows stronger within these individuals that takes on leading roles in the companies of the cluster. These leaders have powerful voices on their own, but when they join forces, their ability to influence the culture and operation of all agents of the cluster becomes stronger than any other factor in the local environment. These organizations of business leaders understand what makes Silicon Valley unique and creates its value. They use their power to promote the culture and collaboration that ensures and sustains the ability and capabilities to drive innovation on a global scale. A great example of this from earlier in the thesis is the CEO of Amazon, Jeff Bezos, who despite leading the market in voice operational services, initiated the Voice Interoperability Initiative which assembles many of Silicon Valley companies competing in the same field in joint force to grow their industry to the benefit of all of them (Fisher, 2019).



9. Conclusion

Porter's classic cluster theory from 1998 explains industry clustering by emphasizing the competitive advantages gained from being where the industry has agglomerated. Locating in a cluster to gain the same competitive advantages as the competitors is necessary to not get left behind. The intense competition pushes companies to perform better and the beneficial cooperation with supply chain activities made possible by proximity provides value to the clustered companies. Overall, industry clustering consolidates the industry in an area and solidifies it against distant competition.

Adding to that, the knowledge-based view offers a different perspective to the argument of why industries cluster. Instead of arguing that a company should cluster to not fall behind, it should cluster because of the cooperative possibilities it provides. That argument is based on redefining a cluster to not only be an agglomerated industry, but instead an industry that has gathered in a not naturally beneficial location, meaning the choice to cluster is deliberate. Narrowing the definition means that the concept of an industry cluster includes

a supportive environment in the form of a local area and government that are dependent on the clustered industry. This adds a new dimension to the classic cluster theory as described.

With a knowledge-based view, an industry cluster provides immense potential for cooperation and knowledge sharing leading to increased innovative capabilities. That is partly because of the supportive environment that integrates as a partner in knowledge sharing through local universities, research centers, and other institutions adding their knowledge capabilities and resources to the industry. It is also because of the commonness that gets established amongst the clustered industry as the proximity allows for frequent interactions and relationship building, similar business culture and educational background.

Silicon Valley is an example of cooperation and knowledge sharing flourishing in such an environment and the innovation that it brings. This is further reinforced by extending the cooperative nature to knowledge sharing between competitors. Silicon Valley can be described as an innovation hub where cooperation between all members of the cluster leads to a collective ability to innovate that cannot be matched by anyone outside the cluster.

Silicon Valley shows that transitioning from an industry cluster to an innovation hub can be valuable to all members, but they have to willingly engage and adapt an openness to their innovation process. The key driver of this change is establishing the sort of trust that lowers the risk involved with sharing knowledge. Engaging in knowledge sharing is only valuable when there is knowledge to share and therefore an industry cluster needs to create talent, attract talent, and be able to retain that talent within the cluster. Silicon Valley proves the impact of adapting a startup culture to motivate knowledge sharing across all levels and having a strong venture capitalist scene to fund the ideas that sprawl from those activities.

Finally, becoming an innovation hub is only a simple first mover advantage compared to other clusters of the industry if it cannot be sustained. The institutional support system that grows around the cluster and the commonness that is established within are both factors that evolve as the cluster does, becoming unique to that specific cluster. It is something that cannot be perfectly imitated by other clusters and therefore becomes key to sustaining its competitive advantage. Cultural knowledge leaders play an important role in continuing the cooperative culture and commonness of the cluster through time and ensuring that it stays stronger and thereby provides more value than in any other competing cluster.

10. LIMITATIONS

This chapter identifies and discusses some points of critic that limits the strength of the arguments made by this thesis.

INVISIBLE CLUSTERS

Porter (1998) argues that because clusters rarely conform to the standard systems of classifying industries, the commonly used stats and figures fail to capture a lot of the actors and relationships that are involved in an industry's competitive environment. This lack of ability to recognize an industrial ecosystem means that many clusters go unnoticed, invisible to the actors involved because it might be shadowed by larger overlapping industries. The invisibility of a cluster results in the inability to ever follow the guidelines presented in this thesis, since they heavily rely on the ability of companies to recognize each other and come together to solve issues in a way that benefits all of them. It is predictable that established clusters have potential for growth and economies of scale that provide strategical advantages and opportunities to members but predicting where they will emerge is difficult (Porter, 1998).

IS LOCALNESS REALLY THE KEY DRIVER OF KNOWLEDGE SHARING?

The arguments of this thesis all have their root in the idea that knowledge is best shared between parties that are located in close geographical proximity. The idea that tacit knowledge sharing flourish more on a local scale is challenged by some. Allen (2000) questions that tacit knowledge is connected to local scale, when explicit knowledge is more or less accepted as being globally available, not limited by geographical boundaries. Instead, he suggests that if firms can form strong relationships with distant contacts, they can also engage in tacit knowledge sharing with those distant counterparts, unaffected by the geographical distance (Allen, 2000).

Allen's (2000) arguments is based on the fact that people move to and from areas with different local context, therefore he argues that no bubble of local context, where knowledge sharing can flow freely, exists. People will always move in and out of these bubbles, providing new knowledge or taking some with them as they leave for another location (Allen, 2000). In this way, the local context will always be a blend of different contexts and therefore the translation of ideas and practices will depend more on the relationship between the parties rather than their geographical proximity to one another (Allen, 2000).

Amin (2000) elaborates on this point, stating that relational proximity can replace local proximity as a factor, eliminating the friction caused by collaborating from a distance. Relational proximity can of course be created through face-to-face contact but can according to Amin (2000) just as well be created at a distance in today's

modern world where the combination of communications technology and easy global business travel allows for frequent interactions between distant parties (Amin, 2000).

Allen (2000) concludes that competitive advantages are gained from "the existence of relationships in which people are able to internalize shared understandings or are able to translate particular performances on the basis of their own tacit and codified understandings" (p.87). Thereby, discounting the clustering of industries as the direct source of a competitive advantage in relation to tacit knowledge sharing, by arguing for the organizational context as more important than the local context in cooperative.

The importance of commonness in having shared local culture and context is further dismissed as Silicon Valley has managed to create a strong common identity amongst its actors while having the largest number of foreigners amongst all industry clusters (Silicon Valley Leadership Group, 2020).

KNOWLEDGE SPILLOVER! – INNOVATION CAN BE TOO OPEN

Since industry clusters are known for having high rates of mobility amongst workers of all skills, individuals of higher rank and with more inside knowledge will be transferring between rival firms more frequent in a cluster environment than outside. This of course has the direct effect that firms have a harder time containing valuable knowledge inside the organization, since the individuals leaving the firm will bring some of the knowledge with them to their new workplace. This direct effect might keep some of the firms with valuable knowledge from engaging in clusters, thereby hurting the potential of an industry cluster.

One thing is to risk knowledge spillover from workers leaving the organization, another thing is having to worry that workers leave a firm you have engaged in knowledge sharing activities with. Knowledge sharing is a key part of developing an innovation hub and it features frequent activities where firms provide access to their internal knowledge. This heavily increases the risk of knowledge spillover from worker mobility, because a firm no longer has to worry only about retaining their own employees, but also the employees of firms they have provided their internal knowledge to. At a point, protecting the shared knowledge will be beyond a firm's control and therefore this indirect effect of the high worker mobility in clusters could lead to firms being hesitant to engaging in knowledge sharing (Fallick *et al.*, 2006).

Worker mobility has previously in this paper been described as a key to innovation because skilled individuals with different knowledge bases are frequently exposed to new organizational knowledge, leading to new thinking and creative problem-solving. The dark side of a high rate of worker mobility is that it could obstruct innovation because firms reduce their investments in human capital as a response to the fact that they are difficult to retain in the organization (Fallick *et al.*, 2006).

Local Area and Governance

When an industry cluster in a location, that location becomes detrimental to the performance of the cluster. As discussed in the analysis, the region and its local government will usually be positive towards an industry cluster as it brings a lot of potential to the area. Once the cluster is settled and sort of locked in place, the relationship between the clustered industry and the region can sometimes change. It is not uncommon that well-established clusters have higher costs of doing business than other places (Silicon Valley Leadership Group, 2020). Cost of doing business in this case could be cost of labor, energy, taxes, and renting property for office space and so on.

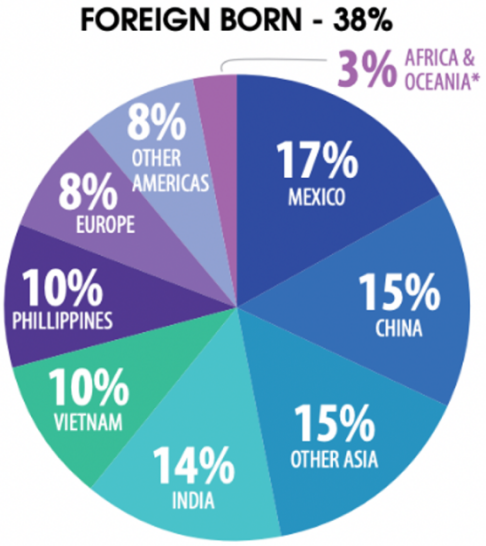
We observe this in Silicon Valley which has the highest cost of doing business in the entire United States (Silicon Valley Leadership Group, 2020). The cost of doing business has increased a lot in Silicon Valley especially during recent years, exemplified by office rent prices which has elevated 50% from 2013 (CBRE, 2020). It is one thing to have the regional support in creating a strong cluster, but if they start milking the industry cluster for cash by raising prices and increasing the costs of living so that employees need higher pay, the benefits of the location might not outweigh the costs of the location in the long-run.

Sustainability of Silicon Valley

Cost of doing business in Silicon Valley is 20% higher than anywhere else in the US and that threatens the lifespan of the cluster (CBRE, 2020). Being the costliest place to be present as a business also means that the cluster has to be the most advantageous location. The largest expense for companies in this regard is wages, because Silicon Valley wages are far ahead of any other tech cluster (CRBE, 2020). Silicon Valley companies have experienced major growth but that leads to higher wage demands from employees. This makes sense if the workers are of the highest quality, but other tech clusters are catching up to the strong worker pool of Silicon Valley (CRBE, 2020). If the common identity shared amongst Silicon Valley workers includes being paid more than anywhere else, but their quality is matched elsewhere, that challenges the sustainability of the Silicon Valley cluster model as a template to follow.

The arguments of this thesis are inspired by Silicon Valley as the example of what any cluster should strive to become, but the fact is that even Silicon Valley experiences emigration of talent. In recent years, cost of living has increased in the industry cluster and the people have reported lower quality-of-life in general (Silicon Valley Leadership Group, 2020). That, along with one of the worst rated daily commutes to and from work and a school system that is lacking behind, is making more people than ever leave Silicon Valley for other parts of the US (Silicon Valley Leadership Group, 2020).

In fact, more people are leaving Silicon Valley than entering these days and fewer people from outside the US are relocating to the California-based tech cluster (Silicon Valley Leadership Group, 2020). This is a scary trend in relation to knowledge spillover and staying ahead of other clusters of the industry as Silicon Valley educated workers travel to other places and talent from outside the cluster is not attracted. A key aspect of this issue which is already present is the fact that the growth of Silicon Valley has led to a shortage of locally educated talent. The local educational system is not large enough to supply the clustered industry with enough workers and therefore it has to rely on people from other backgrounds. A large number of Silicon Valley workers are foreign-born and educated elsewhere, which damages the commonness and shared identity that has been a great strength of the cluster and helped promote collaboration. The figure to the right shows 38% are foreign born and that their origins are evenly split across the entire world (SVIRS, 2020) further decreasing commonalities.



Source: SVIRS - Silicon Valley Institute for Regional Studies. (2020). *Silicon Valley Index 2020.*

The conclusion when looking at Silicon Valley's growth slowing down as other tech clusters are sustaining their growth (Silicon Valley Leadership Group, 2020), could be that this industry cluster's setup might not be as attractive to replicate today as it might have been once. With several new tech clusters on the rise and expanding more rapidly than Silicon Valley (Silicon Valley Leadership Group, 2020), the explanation to the success of this cluster could come down to the fact that the tech industry is made for these fast-rising clusters. Silicon Valley might just have been the first mover, but a first-mover advantage is only a short-term advantage if the lead cannot be sustained.

11. Future Research

Future research should build on the ideas presented in this thesis to further the understanding of how cooperation can co-exist with competition in innovation hubs. Competition in cooperative clusters is not a concept this thesis discusses in detail, but it is something that is necessary to understand.

This thesis maintains a broad scope and engages with the concepts from a top-down 'bird's' eye' perspective. Digging deeper into the inner workings of Silicon Valley, possibly narrowing the scope to specific companies or specific partnerships would be an interesting and different perspective that might shine a light on other factors and even limitations involved with creating a cooperative environment.

This thesis distances itself from clusters that are created in areas with a natural pull, but how are clusters born in places that are not naturally beneficial? Additionally, this thesis concerns itself mostly with well-established clusters, but how do the mechanics that exist in clusters before they become well-established differ from what is described in this thesis?

It could also be interesting for further research to dive into the role of the region that wants to attract the cluster. Understanding their perspective and elaborating on their supporting role could be interesting.

BIBLIOGRAPHY

Journal Articles:

Alcácer, J., & Chung, W. (2007). Location strategies and knowledge spillovers. *Management Science*, *53*(5), 760–776.

Allen, J. (2000) Power/economic knowledge: symbolic and spatial formations. In J. R. Bryson, P. W. Daniels, N. Henry, and J. Pollard (eds) *Knowledge, Space, Economy*. London: Routledge: 15–33.

Amit, R., & Schoemaker, P. J. H. (1993). Strategic assets and organizational rent. *Strategic Management Journal*, *14*(1), 33–46.

Ashton, D., & Giddings, S. (2018). At work in the toybox: Bedrooms, playgrounds and ideas of play in creative cultural work. *International Journal of Entrepreneurship and Innovation*, *19*(2), 81–89.

Barney, J. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management*, *17*(1), 99–120.

Beckman, C. M., Burton, M. D., & O'Reilly, C. (2007). Early teams: The impact of team demography on VC financing and going public. *Journal of Business Venturing*, *22*(2), 147–173.

Beebe, C., Haque, F., Jarvis, C., Kenney, M., & Patton, D. (2013). Identity creation and cluster construction: The case of the paso robles wine region. *Journal of Economic Geography*, *13*(5), 711–740.

Bianchi, M., Cavaliere, A., Chiaroni, D., Frattini, F., & Chiesa, V. (2011). Organisational modes for open innovation in the bio-pharmaceutical industry: An exploratory analysis. *Technovation, 31*(1), 22-33.

Boell, S. K. (2014). A hermeneutic approach for conducting literature reviews and literature searches. *Communications of the Association for Information Systems*, *34*(1), 257–286.

Bohn, D. (2019). Amazon creates a huge alliance to demand voice assistant compatibility. Retrieved September 2, 2020, from The Verge website: https://www.theverge.com/2019/9/24/20881321/amazon-voice-interoperability-initiative-alexa-microsoft-baidu-intel-qualcomm-spotify-assistants

Chesbrough, H. (2003). *Open innovation: The new imperative for creating and profiting from technology*. Boston: Harvard Business School Publishing.

Chesbrough, Henry, Vanhaverbeke, Wim, & West, Joel. (2006). *Open innovation: Researching a new paradigm*. Oxford: Oxford University Press.

Christensen, C. M., & Bower, J. L. (1996). Customer power, strategic investment, and the failure of leading firms. *IEEE Engineering Management Review*, *24*(4), 69–86.

Dahlander, L., & Gann, D. M. (2010). How open is innovation? *Research Policy*, *39*(6), 699–709.

Fallick, B., Fleischman, C. A., & Rebitzer, J. B. (2006). Job-hopping in silicon valley: Some evidence concerning the microfoundations of a high-technology cluster. *Review of Economics and Statistics*, *88*(3), 472–481.

Feldman, M. P. (1999). The new economics of innovation, spillovers and agglomeration: A review of empirical studies. *Economics of Innovation and New Technology*, *8*(1–2), 5–25.

Fisher, C. (2019). Amazon enlists 30 companies to improve how voice assistants work together. Retrieved September 2, 2020, from Engadget website: https://www.engadget.com/2019-09-24-amazon-voice-interoperability-initiative.html

Florida, R. (2002). The economic geography of talent. *Annals of the Association of American Geographers*, *92*(4), 743–755.

Foss, N., & Stea, D. (2014). Putting a realistic theory of mind into agency theory: Implications for reward design and management in principal-agent relations. *European Management Review*, *11*(1), 101–116.

Foss, N. J., Pedersen, T., Reinholt Fosgaard, M., & Stea, D. (2015). Why Complementary HRM Practices Impact Performance: The Case of Rewards, Job Design, and Work Climate in a Knowledge-Sharing Context. *Human Resource Management*, *54*(6), 955–976.

Fu, E., & Hsia, T. (2014). Universities and Entrepreneurial Ecosystems: Elements of the Stanford-Silicon Valley Success. Retrieved September 1, 2020, from Kauffman Fellows website: https://www.kauffmanfellows.org/journal_posts/universities-and-entrepreneurial-ecosystems-stanford-silicon-valley-success#footnotes

Garud, R., & Karnøe, P. (2003). Bricolage versus breakthrough: Distributed and embedded agency in technology entrepreneurship. *Research Policy*, *32*(2 SPEC.), 277–300.

Gassmann, O. (2006, June). Editorial: Opening up the innovation process: Towards an agenda. *R and D Management*, Vol. 36, pp. 223–228.

Gertler, M. S. (2003). Tacit knowledge and the economic geography of context, or the undefinable tacitness of being (there). *Journal of Economic Geography*, *3*(1), 75–99.

Gompers, P., Lerner, J., & Scharfstein, D. (2005). Entrepreneurial Spawning: Public Corporations and the Genesis of New Ventures, 1986 to 1999. *Journal of Finance, 60*(2), 577-614.

Gordon, I. R., & McCann, P. (2000). Industrial clusters: Complexes, agglomeration and/or social networks? *Urban* Studies, *37*(3), 513–532.

Grant, R. (1996). Toward a Knowledge-Based Theory of the Firm. *Strategic Management Journal,* 17, 109-122.

Grimaldi, R., Kenney, M., & Piccaluga, A. (2020). University technology transfer, regional specialization and local dynamics: lessons from Italy. *Journal of Technology Transfer*.

Hargadon, A., & Sutton, R. (2000). Building an innovation factory. *Harvard Business Review,78*(3), 157-217.

Henton, D., & Held, K. (2013). The dynamics of Silicon Valley: Creative destruction and the evolution of the innovation habitat. *Social Science Information*, *52*(4), 539–557.

Hitt, M., Bierman, L., Shimizu, K. and Kockhar, R. (2001). Direct and moderate effects of human capital on strategy and performance in professional service firms: a resource-based perspective. *Academy of Management Review*, 44 (1), 13-28.

Howells, J. R. L. (2002). Tacit knowledge, innovation and economic geography. *Urban Studies*, *39*(5–6), 871–884.

Huizingh, E. K. R. E. (2011). Open innovation: State of the art and future perspectives. *Technovation*, *31*(1), 2–9.

Humphry, J. (2014). Visualising the future of work: Myth, media and mobilities. *Media, Culture and Society*, *36*(3), 351–366.

Kenney, M., & Patton, D. (2007). The Coevolution of Technologies and Institutions: Silicon Valley as the Iconic High- Technology Cluster. In *Cluster Genesis: Technology-Based Industrial Development* (pp. 38-61). Oxford University Press.

Leonard, D., & Swap, W. (2000). Gurus in the garage. *Harvard Business Review*, *78*(6), 71–73, 76.

Malmberg, A., & Maskell, P. (1999). Localised learning and industrial competitiveness. *Cambridge Journal of Economics*, *23*(2), 167–185.

Malmberg, A., & Maskell, P. (2002). The elusive concept of localization economies: Towards a knowledge-based theory of spatial clustering. *Environment and Planning A*, *34*(3), 429–449.

McAveeney, C. (2013). How Do You Define Startup Culture? Retrieved September 4, 2020, from Wired website: https://www.wired.com/insights/2013/09/how-do-you-define-startup-culture/

Morosini, P. (2004). Industrial Clusters, Knowledge Integration and Performance. *World Development*, 32(2), 305-326.

Nonaka, I. (1994). A Dynamic Theory of Organizational Knowledge Creation. *Organization Science, 5*(1), 14-37.

Nonaka, I., Toyama, R., & Nagata, A. (2000). A firm as a knowledge-creating entity: a new perspective on the theory of the firm. *Industrial and Corporate Change*, *9*(1), 1–20.

Nonaka, I., & von Krogh, G. (2009). Tacit knowledge and knowledge conversion: Controversy and advancement in organizational knowledge creation theory. *Organization Science*, *20*(3), 635–652.

Pardes, A. (2020). Silicon Valley Ruined Work Culture Everywhere. Retrieved August 19, 2020, from Wired website: https://www.wired.com/story/how-silicon-valley-ruined-work-culture/

Porter, M. (1979). How competitive forces shape strategy. *Harvard Business Review*, 57(2), 137-145.

Porter, M. (1998). Clusters and the new economics of competition. *Harvard Business Review*, 76(6), 77-90.

Porter, M. E. (2008). The five competitive forces that shape strategy. *Harvard Business Review*, *86*(1), 79-93+137.

Reinholt, M., Pedersen, T., & Foss, N. (2011). Why a central network position isn't enough: the role of motivation and ability for knowledge sharing in employee networks. *Academy of Management Journal*, *54*(6), 1277-1297.

Romanelli, E., & Khessina, O. (2005). Regional industrial identity: cluster configurations and economic development. *Organization Science*, 16, 344–358.

Rosenberg, S. (2017). Silicon Valley's First Founder Was Its Worst. Retrieved August 15, 2020, from WIRED website: https://www.wired.com/story/silicon-valleys-first-founder-was-its-worst/

Rouse, M. J., & Daellenbach, U. S. (2002). More thinking on research methods for the resource-based perspective. *Strategic Management Journal*, *23*(10), 963–967.

Sampson, R. C. (2007). R&D alliances and firm performance: The impact of technological diversity and alliance organization on innovation. *Academy of Management Journal*, *50*(2), 364–386.

Schmitz, H. (2000). Does local co-operation matter? Evidence from industrial clusters in South Asia and Latin America. *Oxford Development Studies*, 28(3), 323–336.

Silicon Valley Bank. (2020). Partner, Rival, Acquirer: A Startup's CFO's Perspective on Navigating a Competitive Market. Retrieved September 1, 2020, from Silicon Valley Bank website: https://www.svb.com/blogs/silicon-valley-bank/looker-and-google-partnership-to-acquisition

Solis, B. (2015). Why Businesses Back Innovation Centers. Retrieved September 2, 2020, from TechCrunch website: https://techcrunch.com/2015/10/05/why-businesses-back-innovation-centers/?guccounter=1

Squazzoni, F. (2009). Social entrepreneurship and economic development in Silicon Valley: A case study on the Joint Venture: Silicon Valley Network. *Nonprofit and Voluntary Sector Quarterly*, *38*(5), 869–883.

Staber, U. (2010). Imitation without interaction: How firms identify with clusters. *Organization Studies*, *31*(2), 153–174.

Sørensen, J. B., & Fassiotto, M. A. (2011). Organizations as fonts of entrepreneurship. *Organization Science*, *22*(5), 1322–1331.

Taylor, E., & Love, J. (2015). Apple, BMW in courtship with an eye on car collaboration. Retrieved September 2, 2020, from Reuters website: https://www.reuters.com/article/us-apple-bmw-courtship-insight/apple-bmw-in-courtship-with-an-eye-on-car-collaboration-idUSKCN0Q52CW20150731

Tomlinson, P. R., & Fai, F. M. (2013). The nature of SME co-operation and innovation: A multi-scalar and multi-dimensional analysis. *International Journal of Production Economics*, 141(1), 316–326.

Wenger, E. (2000). Communities of Practice and Social Learning Systems. *Organization*, *7*(2), 225–246.

Wiklund, J., & Shepherd, D. (2003). Knowledge-based resources, entrepreneurial orientation, and the performance of small and medium-sized businesses. *Strategic Management Journal*, *24*(13), 1307–1314.

Willard, B., & Fair, G. (2018). Introducing Data Transfer Project: an open source platform promoting universal data portability. Retrieved September 2, 2020, from Google Open Source Blog website: https://opensource.googleblog.com/2018/07/introducing-data-transfer-project.html

Woodward, D., Figueiredo, O., & Guimarães, P. (2006). Beyond the Silicon Valley: University R&D and high-technology location. *Journal of Urban Economics*, *60*(1), 15–32.

Books:

Barney, J. (1997). *Gaining and sustaining competitive advantage*. Reading, Mass: Addison-Wesley.

Barney, J. & Hesterly, W. (2012). *Strategic management and competitive advantage: Concepts* (4. ed., International ed.). Upper Saddle River, N.J: Pearson Education.

Bergman, E. & Feser, E. (2020). *Industrial and Regional Clusters: Concepts and Comparative Applications* (2nd ed.). University of West Virginia, Morgantown: University of West Virginia Web Book of Regional Science.

Denning, S. (2000). *The springboard: How storytelling ignites action in knowledge-era organizations*. Boston: Butterworth-Heinemann.

Grant, R. (2016). *Contemporary strategy analysis: Text and cases* (9.th ed.). Chichester: John Wiley & Sons.

Hargadon, A. (2003). *How breakthroughs happen: The surprising thruth about how companies innovate.* Boston: Harvard Business School Publishing.

Kim, C. & Mauborgne, R. (2005) *Blue ocean strategy: how to create uncontested market space and make the competition irrelevant* Boston, Mass: Harvard Business School Press

Lee, C. (2001). The *Silicon Valley edge: A habitat for innovation and entrepreneurship*. Stanford: Stanford University Press.

Nelson, Richard R, & Winter, Sidney G. (1982). *An evolutionary theory of economic change*. Cambridge, Mass: Belknap Press of Harvard University Press.

Saxenian, A. (1994). *Regional advantage: Culture and competition in Silicon Valley and Route 128.* Cambridge, Mass: Harvard University Press.

Reports:

CBRE. (2020). *Scoring Tech Talent 2020*.
Retrieved from https://www.cbre.us/research-and-reports/Scoring-Tech-Talent-in-North-America-2020

Colliers International. (2020). *2020 Q1 San Jose-Silicon Valley Market Research Report*.
Retrieved from https://www2.colliers.com/en/research/san-francisco-bay-area/2020-q1-san-jose-silicon-valley-market-research-report

Deloitte. (2016). *How to innovate the Silicon Valley way: Tapping into the Silicon Valley innovation ecosystem*.
Retrieved from https://www2.deloitte.com/content/dam/insights/us/articles/tapping-into-silicon-valley-culture-of-innovation/DUP_3274_Silicon-Valley_MASTER.pdf

OECD – Organization for Economic Co-operation and Development. (1997). *National Innovation Systems*.
Retrieved from https://www.oecd.org/science/inno/2101733.pdf

Silicon Valley Leadership Group. (2015). *Silicon Valley Competitiveness and Innovation Project*. Retrieved from https://www.svcip.com/files/SVCIP_2015.pdf

Silicon Valley Leadership Group. (2020). *Silicon Valley Competitiveness and Innovation Project*. Retrieved from https://www.svcip.com/files/SVCIP%202020%20-%20FINAL%203.9.2020.pdf

Startup Genome. (2020). *The Global Startup Ecosystem Report*.
Retrieved from https://startupgenome.com/reports/gser2020

Statista. (2018). *Total information communication technology (ICT) market spending worldwide from 2016 to 2022*.
Retrieved from https://www-statista-com.esc-web.lib.cbs.dk:8443/statistics/946785/worldwide-ict-spending/

SVIRS - Silicon Valley Institute for Regional Studies. (2020). *Silicon Valley Index 2020*.
Retrieved from https://jointventure.org/images/stories/pdf/index2020.pdf

USPTO - U.S. Patent and Trademark Office. (2015). *Listing of All U.S. Metropolitan and Micropolitan Areas, Total Utility Patent Counts, 2000-2015*.
Retrieved from https://www.uspto.gov/web/offices/ac/ido/oeip/taf/cls_cbsa/allcbsa_gd.htm