Understanding Innovation Clusters

An Exploratory Study of Israel and Southern Sweden

May 2013

Author: Johannes Ivarsson
Program: Master of Science in Industrial Engineering and Management
Supervisor: Carl-Johan Asplund
External Supervisor: Rikard Jacobsson, PwC

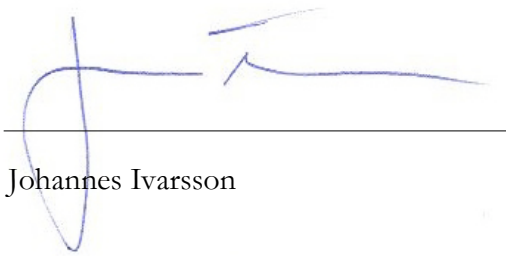
Acknowledgements

This thesis was conducted at the Faculty of Engineering at Lund University as a part of my Master of Science in Industrial Engineering and Management. The idea of the study and its purpose was initiated and developed by me in collaboration with PwC and Rikard Jacobsson.

I would like to send a special thank you to Carl-Johan Asplund, my supervisor at Lund University who has been constantly challenging and pushing my boundaries. My creativity and my abilities have been thoroughly tested and developed due to his inspiring supervising approach.

I would also like to direct my gratitude to Rikard Jacobsson, my supervisor at PwC in Malmö. Without your sharp intellect and your ability to analytically understand and cut through complex problems, this thesis would certainly be a lot more "fuzzy". Further on, big thank you for letting me incubate and develop ideas in your great office in Malmö.

Malmö, May 20, 2013



Johannes Ivarsson

Abstract

Title

Understanding Innovation Clusters, An Exploratory Study of Israel and Southern Sweden

Author

Johannes Ivarsson

Supervisor

Carl-Johan Asplund

Presentation date

May 23 2013

Purpose

The main purpose of this explorative master thesis is to describe, explain and understand the main success factors that lie behind the regional innovation system in Silicon Wadi in Israel. This is done in order to suggest some tentative ideas on how to further develop the emerging ICT cluster in Malmö/Lund.

Four sub purposes have been applied in order to achieve the main purpose:

- To understand why Silicon Wadi in Israel has become such a successful and sustainable ICT cluster
- To benchmark the cluster in Silicon Wadi and the one in Malmö Lund: Which are (or seems to be) the key similarities and differences between Silicon Wadi in Israel and the Malmö/Lund region?
- To use the benchmarking to propose ideas on how to address some of the challenges that faces Malmo/Lund as a regional innovation system
- To develop a theoretical framework for exploring and comparing regional innovation systems.

Method

The study has been conducted mainly through two case studies where the ICT clusters in Silicon Wadi and Malmö/Lund have been studied. The method used to carry out these studies has primarily been literature studies, collecting mainly qualitative data.

Theoretical Framework

The empirical data has been analyzed with a model developed in this thesis called *The Innovation Ecosystem Model.* This model is a composition of theories within the theoretical sphere around clusters and innovation systems. The model is an attempt to describe and understand a regional innovation system, or a cluster, in three different dimensions namely Context, Actors and Activities. The context has been analyzed using Michael E. Porter's diamond model, the actors with the triple helix model and the activities with Charles Edquist's activity based approach to innovation systems.

Conclusions

There are many success factors behind the Israeli ICT cluster in Silicon Wadi, but some of the main factors determining the success of the cluster have been focused government initiatives, well developed capital markets, well developed commercialization infrastructure, a focus on high quality R&D and education, the characteristics the military service imposes on the population, a culture well suited for entrepreneurial endeavor and a high degree of international collaboration.

In order to create a bright future of the cluster in Malmö/Lund actions needs to be taken on three different levels, societal challenges such as integration problems and high unemployment rates must be addressed, systemic challenges in the innovation system has to be addressed and finally a creative environment has to be built in accordance with Richard Florida's theories on creative capital. The Israeli cluster can be a role model in addressing mainly the systemic challenges in Malmö/Lund where programs such as Yozma, a venture capital policy program, can be a source of inspiration.

Key words

Cluster, Innovation System, Innovation, Entrepreneur, Silicon Wadi, Information and Communication Technology – ICT, Innovation Policy, Venture Capital

Definition of Important Terms and Concepts

Cluster - a regional and sector specific system of innovation

Innovation System – An Innovation system is including all important economic, social, political, organizational, institutional and other factors that influences the development, diffusion, and use of innovations

Innovation – Innovations are novel combinations of knowledge, resources etc. subject to attempts at commercialization, or carried out in practice

Entrepreneurship – The work of systematic innovation, the innovation process, is carried out by entrepreneurs in what is called entrepreneurship or entrepreneurial activity.

Venture Capital – Capital invested in a project in which there is a substantial element of risk, typically a new or expanding business

Business Angel – A business angel is an affluent individual who provides capital for a business start-up, usually in exchange for convertible debt or ownership equity. Tendencies towards an increasing number of angel investors organizing themselves into angel groups or angel networks can be seen today.

Startup – A startup is a human institution designed to create a new product or service under conditions of extreme uncertainty.

Table of Content

Table of figures

1. Introduction

This chapter aims at "setting the stage" for the thesis. It provides the reader with the background of the thesis, the purpose and the overall disposition of how the thesis is structured.

1.1 Background

Josef Schumpeter, 1934, was one of the first to acknowledge innovation as the driving force behind economic growth. He defied the classical economic models by saying that the main driver of the economy was not price but rather novel solutions put on the market. Today people look to innovation hot spots such as Silicon Valley in California to find out more about this invisible, though so powerful force in driving economic growth, called innovation. In 1990 Porter wrote his article on *The Competitive Advantage of Nations,* where he argues "A nation's competitiveness depends on the capacity of its industry to innovate and upgrade".[1] A latter scholar, Richard Florida, 2001, described in his book *The Flight of the Creative Class* how the economy today is fuelled by creativity, as opposed to fuelled by raw material as it was during and the industrial age. He means that creativity is important because it is what creates economic growth through innovations today and it will be even more important in the future. Innovative clusters are often said to drive economic growth, no wonder politicians and business leaders want innovation to happen in their region or organization. In order to better understand what makes a region innovative this thesis explores the creative and innovative milieu in Silicon Wadi in Israel. The thesis also provides a framework for describing, understanding and analyzing regional innovation systems.

Israel is an innovation hot spot in the Middle East and a vastly interesting entrepreneurial nation. Venture Capital investments per capita are 2.5 times that in the US and 30 times that of Europe. Israel, the size of New Jersey, with a population of 7.1 million attracts more venture capital than the population of 145 million in Great Britain, France and Germany combined. Besides the US, Israel has the most companies listed on Nasdaq[2].

Why is Israel so successful when it comes to building a well performing innovation cluster? That was the main question that caught my attention and led to this thesis. Is the

[1] Michael E. Porter, *The Competitive Advantage of Nations*, Harvard Business Review, 1990, p. 73
[2] Irwin Steltzer, *The rest of the world can learn a lot from the Israeli formula for growth,* The Wall Street Journal. 2010-01-24.

Israeli entrepreneurial movement one of its kind or are there factors that can be replicated and strategies to implement in other parts of the world?

The Southern Sweden innovation system is often debated, new organizations to foster innovation are created, and a lot of taxpayers' money is invested in trying to enhance and develop the entrepreneurial activity in this region. In an article in the local newspaper Sydsvenskan, 2010-11-27, called "*Oredan kostar miljoner*" translated into *"The mess costs millions",* the innovation system in Malmö and Lund was mapped. From the extensive network of organizations, institutional investors and incubators there seemed to be a lot of confusion and a lot of capital flowing around between the actors in the innovation system, but a little outcome[3].

This thesis aims at exploring and understanding some of the success factors and drivers behind the Israeli economic miracle. These findings can be used as guidelines in how to build a successful innovation cluster in the ICT industry. The thesis can also be used to inspire policy makers, entrepreneurs and big-business leaders to take the lead in trying to create a clearer strategy and more order in the Southern Swedish innovation system.

1.2 Problem Discussion

In the thesis I have chosen to explore geographical clusters of ICT businesses from three different perspectives, Context, Actors and Activities. These three perspectives combine theory from researchers within cluster theory and innovation systems, such as Michael E. Porter and Charles Edquist, and builds upon typical models used to analyze innovation systems. The three perspectives are combined in this thesis in the *Innovation Ecosystem Model* described in chapter four. The model provides a structured way to discuss the empirics from the two innovation systems in the study, Silicon Wadi in Israel and Malmö/Lund in Sweden. Israel will provide the basis for the discussion since the cluster in Silicon Wadi is seen as the more well developed cluster in the study; the empirics from Malmö/Lund will then be analyzed, compared and discussed using the same model. This "projection" of the empirics concerning Malmö/Lund on the Israeli empirics, will then provide a framework for further discussing the similarities and differences between the systems. The goal is then to identify a number of improvement opportunities in the innovation system in Malmö/Lund.

[3] Viktor Ström, *Oredan kostar miljoner*, Sydsvenskan. 2010-11-27, p. L4-L7

1.3 Purpose

The main purpose of this explorative master thesis is to describe, explain and understand the main success factors that lie behind the regional innovation system in Silicon Wadi in Israel. This is done in order to suggest some tentative ideas on how to further develop the emerging ICT cluster in Malmö/Lund.

Four sub purposes have been applied in order to achieve the main purpose:

- To understand why Silicon Wadi in Israel has become such a successful and sustainable ICT cluster
- To benchmark the cluster in Silicon Wadi and the one in Malmö Lund: Which are (or seems to be) the key similarities and differences between Silicon Wadi in Israel and the Malmö/Lund region?
- To use the benchmarking to propose ideas on how to address some of the challenges that faces Malmo/Lund as a regional innovation system
- To develop a theoretical framework for exploring and comparing regional innovation systems.

1.4 Delimitations

The thesis will focus on geographical clustering of ICT-businesses, so called specialized clusters. General clusters will not be examined in this thesis. ICT means companies within software, web (social media, Software as a Service - SaaS, web applications etc.) and new media (online media, mobile applications, etc.). Hardware organizations such as Intel may also occur in the study, but focus will be on the areas mentioned above.

The geographic delimitations will be the clusters of Silicon Wadi and Malmö/Lund.

Considering the topic, the thesis will not focus on the national level, but rather on a local/regional level of entrepreneurial activity.

1.5 Disposition of the Thesis

1.5.1 Introduction and Research Design

The first chapter, *Introduction*, provides the reader with the background of the thesis, the problem discussion, the purpose as well as the important terms and concepts used in the thesis.

In chapter two, *Research Design*, the chosen methodology of the thesis is presented alongside a discussion around the quality of the study.

1.5.2 Theoretical Framework

The theoretical framework presented in chapter three, *Theoretical Framework,* provides the reader with a background to the theories and concepts used in the thesis, their interdependence and how they are related in the analysis parts of the thesis. The first part of the chapter describes the most important theoretical fields in this thesis, namely:

- Systems of Innovation
- Clusters
- Innovation
- Entrepreneurship

This is done in order to orient the reader through the different concepts but also to make clear definitions of how the concepts are used in this thesis.

In chapter four, *The Innovation Ecosystem Model,* the different models for understanding and analyzing a Regional Innovation System is described and combined into the specific framework used in the study, *The Innovation Ecosystem Model.* The model has been applied throughout the thesis in order to fulfill the purpose of the thesis in a structured way.

1.5.3 Empirical Data

Chapter five and six presents the empirical data collected in the study.

Chapter five, *The ICT Cluster in Israel's Silicon Wadi,* presents the empirical data around Silicon Wadi. The empirics describe the cluster from a number of perspectives and aims to give the reader a comprehensive understanding of the ICT cluster in Israel.

Chapter six, *The ICT Cluster in the Malmö/Lund Region,* aims to compile the empirics and give the reader a background of the innovation and business environment in Malmö and Lund. The innovation system is described from different perspectives, the same as in the study of Silicon Wadi, and the main findings around challenges and opportunities derived from OECD's territorial review from 2012 are integrated.

1.5.4 Analysis and Discussion

Chapter seven, *The Innovation Ecosystem Model in Practice,* is the chapter containing the analysis and discussion of the study.

In chapter seven the analysis model, *The Innovation Ecosystem Model*, has been applied on the Israeli ICT-cluster. The empirics from Malmö/Lund have then been "projected" on the empirics from Silicon Wadi in order to analyze the main differences and similarities between the two clusters.

1.5.5 Conclusions

In chapter eight the main purpose of the thesis was elaborated upon and discussed. The main purpose in the thesis is:

The main purpose of this explorative master thesis is to describe, explain and understand the main success factors that lie behind the regional innovation system in Silicon Wadi in Israel. This is done in order to suggest some tentative ideas on how to further develop the emerging ICT cluster in Malmö/Lund.

1.5.6 Knowledge Contribution and Future Research

The final chapter of this thesis reflects upon the knowledge contribution of the study. Contributions to academia, industry and the political sphere have been stated in this last chapter.

Finally some suggestions on future research concerning the fields of innovation systems and clusters have been made.

2. Research Design

This chapter describes the research approach as well as the actual work methodology used in the thesis. The chapter defines the research approach used in the thesis, how the data collection has been made, and finally it addresses the quality of the study.

2.1 Research Approach

2.1.1 Exploratory, Descriptive, Explanatory and Problem Solving Studies

The main methodology approaches are according to Höst et al., 2006, exploratory, descriptive, explanatory, and problem solving[4]. An exploratory approach is used when the study aims at gaining a deep understanding on how something works. A descriptive approach aims at finding out and describing how something works. An explanatory study aims at identifying cause and effect relations and explanations on how something works. Lastly the problem solving approach aims at finding a solution to an identified problem.

This thesis

The purpose of this thesis is to understand the Israeli innovation system and how it works; hence an exploratory approach will be the main approach in this thesis. However the thesis also aims at understanding the innovation system in Malmö/Lund through the lenses of the Israeli innovation system and proposing ideas on how to better foster innovation in Malmö/Lund. This is also resulting in an approach close to the problem solving approach.

2.1.2 Inductive, Deductive and Abductive Approaches

A study moves between different level of abstractions, both theory and empirics. An inductive method is a method where general theoretical claims are based on gathered data and empirics. A deductive method, on the other hand, is a method where assumptions about the empirics first are formed in the form of theories. These theories are then verified by the previously collected data. The abductive approach is a combination of the inductive and deductive approaches[5].

[4] Martin Höst et al., *Att genomföra examensarbete*, Lund, Studentlitteratur, 2006, p. 43
[5] Göran Wallén, *Vetenskapsteori och Forskningsmetodik,* Lund, Studentlitteratur, 1996

This thesis

This thesis is abductive in its approach and method. The theories in the area of clusters and innovation systems are extensive and the theoretical framework chapter maps these. This is a deductive approach since the collected data has been collected according to the theoretical framework and a model developed during the study. Since the study of clusters is rather complex an inductive approach has also been applied. During the collection of data and empirics an open mind has been kept to new findings.

2.2 Data Collection in Practice

The method that has been used in the study is primarily case studies. According to the book "*Att genomföra examensarbete*[6]" a case study is a method well suited in exploratory studies. It collects both qualitative and quantitative data, but with a focus on qualitative data. Data collection and analysis of qualitative data is an iterative and integrated process in a case study. The data collection of quantitative data is done the same way as when using the methodology survey[7]. There are two case studies that have been conducted in this thesis. The data has been collected with the *Innovation Ecosystem Model* in mind, providing a structure for the following analysis and discussion.

2.2.1 The Innovation Ecosystem Model - Context, Actors and Activities

In order to analyze and being able to compare the two different innovation clusters in the study, a framework called the *Innovation Ecosystem Model* has been developed and applied. The model describes and explains innovative clusters through three lenses.

- Context – that is describing the context in which the cluster exists. It is important to put forward both "hard" factors such as legislation, and "soft" factors such as culture, when describing and outlining the context in which a cluster exists.
- Actors – that is describing the main actors, or stakeholders, in a cluster. Sorted in to three main groups: Academia, State and Industry. These three categories provide a base for analysis. In today's clusters many organizations are hybrid organizations, one example can be a firm owned by the government.

[6] Martin Höst et al., *Att genomföra examensarbete*, Lund, Studentlitteratur, 2006, p. 43
[7] Martin Höst et al., *Att genomföra examensarbete*, Lund, Studentlitteratur, 2006, p. 35

- Activities – that is mapping and describing the different activities being carried out by the actors in the innovation system. When understanding and mapping the activities the following questions can be asked:
    - What are the activities characterizing the cluster?
    - What activities are primary and what are supporting?
    - How are these activities related?

2.2.2 Case Study – Silicon Wadi

This is the most extensive case study in the thesis. The case study has been carried out mainly through literature studies, and collection of secondary data. This was done in order to map all the "parts" in the cluster and how they relate to each other. There are a lot of sources on the Israeli innovation system and the cluster in Silicon Wadi, books and scientific articles. Hence the thesis' focus is to combine these sources into a holistic view of the cluster. Due to this the focus lies in studying secondary sources. After understanding and consolidating the external picture in this thesis another thesis or study might explore and understand the complementary internal picture through interviews and observations. The study has collected both quantitative and qualitative data.

2.2.3 Case Study – Malmö/Lund

This case study has been focused on archive analysis, which means, for example to examine reports on the subject one is researching[8]. Although some meetings with experts have been carried out, see section Interviewees below. The case study of Malmö/Lund is not that as extensive as the one on Israel since understanding the Israeli cluster is the main focus of the thesis. However it is important to have a basic knowledge around Malmö/Lund in order to understand the innovation environment in the region through applying the *Innovation Ecosystem Model.*

2.2.4 Comparison of the Two Case Studies

The empirical data collected in the two case studies has been compared and discussed within the framework of the *Innovation Ecosystem Model*, described more in detail in the theoretical parts of this thesis. The analysis and discussion has been carried out this way in order to extract similarities and differences between the two clusters. The findings of

[8] Martin Höst et al., *Att genomföra examensarbete*, Lund, Studentlitteratur, 2006, p. 35

this analysis have been resulting in an array of ideas of how Malmö/Lund eventually can perform better as an innovation cluster.

2.3 Quality of the Study

Below, the most important quality aspects of a study are presented, reliability and validity. A comment on the sources used, are also made.

2.3.1 Reliability

High reliability is reached through diligence in the data collection and the analysis. It is important to describe how the work has been done in order to give the reader an opportunity to understand and validate how the work has been carried out[9].

To strengthen the reliability of this study the work method has been clearly described. The collection of data has been well structured and the sources are easily to be found in the text. The analysis model described in the Theoretical Framework also gives a clear picture of how the analysis has been carried out. The reliability has also been strengthened through continuous input and reviews on the thesis from both academic experts such as Professor Charles Edquist, CIRCLE at Lund University, and Carl-Johan Asplund, Lund University, as well as from business experts as Rikard Jacobsson, director at PwC Advisory, Malmö.

2.3.2 Validity

The validity is a measure on how valid the measurements in the study are.[10] To be able to strengthen the validity of the study different forms of data collection have been conducted. The data collection has comprised informal meetings/interviews and attendance on a number of events related to the innovation cluster in Malmö/Lund combined with an extensive literature study with information from many different reliable sources.

2.3.3 Sources

The main sources for the thesis have been scientific articles, academic literature, as well as web pages from governmental and academic organizations. The sources have been selected with care in order to make the information in this thesis as rigid and reliable as

[9] Martin Höst et al., *Att genomföra examensarbete*, Lund, Studentlitteratur, 2006, p. 41
[10] Ibid, p. 42

possible. To find the academic articles Google Scholar has been the main search tool. Examples of search phrases used are: Innovation, Entrepreneurship, Innovation Systems, Regional Innovation Systems, Clusters, Silicon Wadi.

In the thesis no formal interviews have been conducted, however, many informal meetings and interviews have been carried out with the following people:

- Charles Edquist, Rausing Professor in Innovation, CIRCLE, Lund University
- Dr. Jan Dexel, Ministry of Economic Affairs, The Netherlands
- Magnus Lundin, CEO, Swedish Incubators & Science Parks
- Jan Sturesson, Global Leader, Government/Public Services, PwC
- Laurent Probst, Partner, Economic Development Policies and Innovation, PwC
- Lars Persson, CEO, Sydsvensk Entreprenörfond
- Bodil Rosvall Jönsson, CEO, Business Region Skåne

The author has also attended several events around ICT Innovation, for example Startup Dojo at Media Evolution and Venture Capital Forum by Connect Skåne, as well as running an ICT startup in the Malmö/Lund innovation system in parallel with the thesis, giving insights and experiences from the system in the region. Experiences from the author's role as former CEO at Lunicore (2011-2012), a student consultancy owned by Lund University and private shareholders, have also been applied in the thesis.

3. Theoretical Framework

This chapter provides the reader with a background to the theories and concepts used in the thesis, their interdependence and how they are related in the analysis parts of the thesis. The first part of the chapter describes the most important theoretical fields in this thesis, namely:

- *Systems of Innovation*
- *Clusters*
- *Innovation*
- *Entrepreneurship*

This is done in order to orient the reader through the different concepts but also to make clear definitions of how the concepts are used in this thesis.

3.1 Definitions in This Thesis

In this thesis a cluster is defined as a regional and sector specific System of Innovation, SI. Hence the cluster theories described by Porter and the theories of system of innovation described by Edquist in the sections ahead are interrelated. The cluster theories hence are applicable on the regional system of innovation and vice versa.

Edquist describes the main function of a SI as pursuing the innovation process. The definition of innovation used in this thesis is Schumpeter's as stated in 1934, *Innovations are novel combinations of knowledge, resources etc. subject to attempts at commercialization (or carried out in practice).* The work of systematic innovation, the innovation process, is carried out by entrepreneurs in what is called entrepreneurship or entrepreneurial activity, as defined by Peter F. Drucker, 1985. According to Porter, 1998, the successful cluster reinforces itself in a positive feedback loop. The illustration below, Figure 1, is an attempt by the author to describe the innovation ecosystem of a cluster or a sector specific regional innovation system.

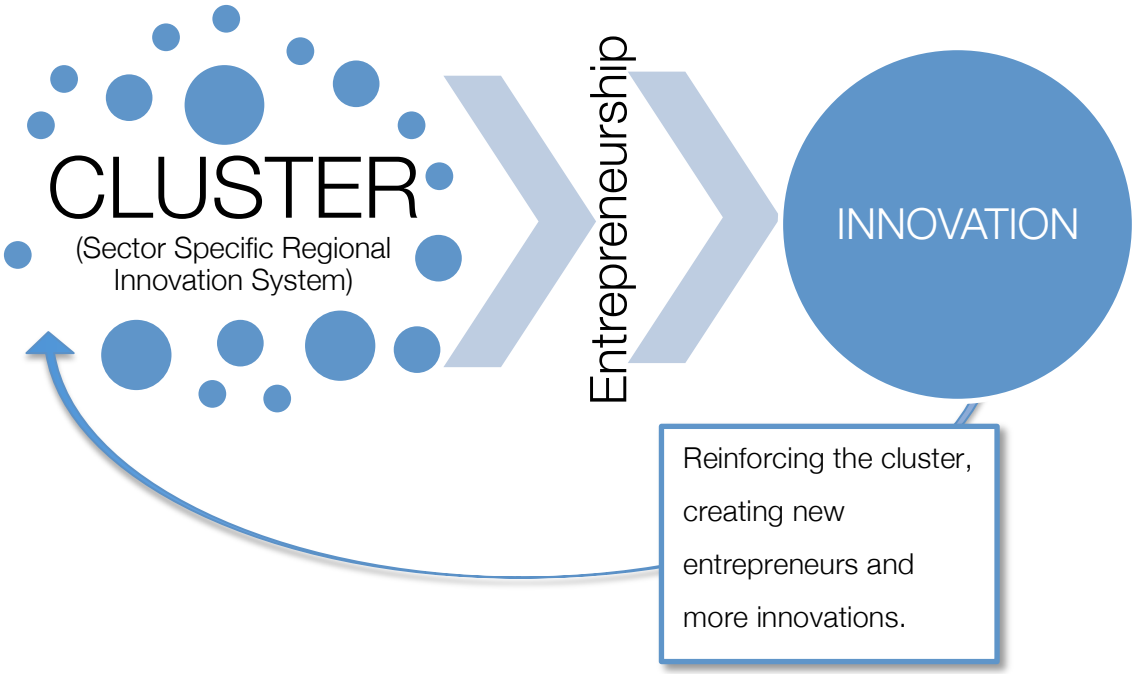


Figure 1: A visualization of the flows in a cluster and an attempt to show the relations between the terms cluster, innovation and entrepreneurship and the ecosystem-like structure of an innovation system.

3.2 Systems of Innovation Theory

According to Edquist, 2006, "The overall *function* of a SI is to pursue innovation processes, i.e. to develop, diffuse and use innovations"[11]. One can broadly define a SI as including all important economic, social, political, organizational, institutional and other factors that influences the development, diffusion, and use of innovations, according to Edquist 2011[12].

3.2.1 Main Components of SI

Furthermore, Edquist means that the main components in a SI are *institutions* and *organizations*.

Institutions are sets of common habits, norms, routines, established practices, rules, or laws that regulate the relations and interactions between individuals, groups and organizations. Examples of institutions are patent laws, and rules and norms affecting the relations between firms and universities. If the SI is pictured as a game, the institutions can be said to be the rules of the game.

---

[11] Charles Edquist, *Systems of Innovation, Perspectives and challenges*, The Oxford Handbook of Innovation, Oxford, Oxford University Press, 2006, p. 182

[12] Charles Edquist, *Design of Innovation Policy through diagnostic analysis: identification of systemic problems (or failures),* Industrial and Corporate Change, Oxford, Oxford University Press, 2011, p.4

Organizations are formal structures that are consciously created and have an explicit purpose. Examples can be universities, firms and venture capital organizations. With the game-analogy used above, the organizations can be said to be the players of the game.

3.2.2 Regional Systems of Innovation – RSI

Important to start with is a definition of a *Region:*

Important base of economic coordination on the meso-level. Between the national level and the level above the local or municipal level.

Regional Systems of Innovation, RSI, is closely related to the term cluster. Clusters are defined in the next section, whereas RSI are defined by Cooke et al., 2004, as:

Interacting knowledge generation and exploitation subsystems linked to global, national and other regional systems[13].

Clusters and RSIs can, and often do, exist in the same territory. The cluster is sector specific but the RSI has a more generic sector orientation.

3.2.3 Different Types of SI:s

According to Edquist, 2006, SI:s can be supranational, national and subnational. At the same time they can also be sectorial within these different geographical units[14]. Edquist points out three different ways to contain a SI within its boundaries[15].

1. Spatially/Geographical
2. Sectorial
3. In terms of activities

A cluster, what will be used as the term examined in this thesis, is a combination of a regional and sectorial SI. Hence the SI theory implicitly is appropriate for analyzing clusters. In the following section, clusters will be examined more in detail.

[13] Björn T. Asheim et al., *Knowledge bases and regional innovation systems: Comparing Nordic clusters*, Research Policy 34, Elsevier, 2005, p. 1174
[14] Charles Edquist, *Systems of Innovation, Perspectives and challenges*, The Oxford Handbook of Innovation, Oxford, Oxford University Press, 2006, p. 199
[15] Ibid, p. 199

3.3 Cluster

Looking at the economic map of today there are tendencies towards both concentration and dispersal. Still though, there is a trend for economic activities to agglomerate into localized geographical clusters. Comparative advantages such as natural resources or infrastructural capital is not as important as it used to be in building competitive advantages for a nation or region. Competitive advantage today rests on making more productive use of inputs, a practice that requires continuous innovation[16].

3.3.1 What is a Cluster?

"Clusters are geographic concentrations of interconnected companies and institutions in a particular field[17]."

Geographical clusters are often categorized into generalized or specialized clusters. Both types of clusters are based on the notion of externalities, the positive spillover effects created when companies co-localize and collaborate, and that the cluster, the whole, is greater than the sum of its parts because of spatial proximity[18].

- Generalized clusters reflect the fact that human activities tend to agglomerate in urban areas. Cities are obvious examples of generalized clusters. Generalized clusters are not looked further into in this thesis.
- Specialized clusters reflect the tendency of companies in the same or related industries to locate in the same place. The basis for such a cluster is firms performing different but linked activities. This thesis will focus on specialized clusters.

Both specialized and generalized clusters create externalities that in turn create two types of interdependencies[19]:

- Traded interdependencies. The direct trade between firms in a cluster made easier by geographical proximity.
- Untraded interdependencies. This refers to the less tangible benefits such as the creation of institutions, labor pools and broader socio-cultural phenomena.

[16] Michael E. Porter, *Clusters and the New Economics of Competition*, Harvard Business Review 1998, p. 78
[17] Ibid, p.78
[18] Peter Dicken, *Global Shift, Mapping the contours of the changing world economy*, 5th Ed., London, Sage Publications, 2007. p. 21
[19] Ibid, p. 22

Clustering facilitates the following three processes: face-to-face contact, social and cultural interaction and enhancement of knowledge and innovation.

In clusters one can find both competition and cooperation existing side by side. Without competition a cluster will lose its competitive advantage and ultimately fail. Cooperation, much of it vertical, is also vital to a clusters competitive advantage and ability to create innovations. This dualistic relationship between cooperation and competition can exist because it occurs on different levels and among different players in the cluster. Porter, 1998, argues in *Clusters and the New Economy of Competition*, that clusters represent a new form of geographical organizational form, in between the arm-lengths markets and the vertically integrated organization where independent and informally linked companies and institutions coexist. It is a new way of organizing the value chain that creates advantages in increased flexibility, efficiency and effectiveness[20].

3.3.2 Why do economic activities cluster?

In Global Shift, 2007, Dicken states that one reason to the continuing significance if localness in the creation and diffusion of knowledge lies in the nature of knowledge itself, which is basically of two kinds:

- Tacit
- Codified

Codified knowledge is easily transmitted whilst tacit knowledge faces a significant decay curve when faced with increased geographical distance[21].

Porter takes a competition-based view to why clusters occur. He means that modern competition depends on productivity, not on access to inputs. Productivity rests on how companies compete, not the industry they compete in. Clusters are important in shaping the way companies compete and they affect competition in three broad ways[22]:

1. Increase in productivity
2. Increase in innovation ability
3. The creation of new business formation

---

[20] Michael E. Porter, *Clusters and the New Economics of Competition*, Harvard Business Review 1998, p. 80
[21] Peter Dicken, *Global Shift, Mapping the contours of the changing world economy*, 5th Ed., London, Sage Publications, 2007. p. 100
[22] Michael E. Porter, *Clusters and the New Economics of Competition*, Harvard Business Review 1998, p. 80

Richard Florida, 2001, states in his book *The Rise of the Creative Class* that clustering occurs not because companies cluster in a geographical area but rather that talented people cluster in a geographical area. He is referring to both the Human Capital Theory and the theory of Social Capital when he states his own theory of Creative Capital[23]. Florida states that regional economic growth is driven by geographical localization decisions made by people from the creative class. These people prefer to cluster in diverse and tolerant places, open for new ideas. He also states that economic growth in a region or cluster is based on the three T:s, Technology, Talent and Tolerance.[24]

While Dicken, 2007, takes the *Knowledge View* and Porter, 1998, the *Competitive View,* Florida, 2001, can be said to take the *Human Centered View.*

3.3.3 The Creation, Growth and Decline of a Cluster

A cluster's roots can often be traced back in history, and is therefore said to be path dependent. According to Porter, 1998, there are several reasons a cluster is created[25]:

- An unusual, sophisticated, or stringent local demand
- From prior existence to supplier industries
- From one or two innovative companies that stimulates the growth of others
- From chance event that creates an advantageous factor
- From national technology and innovation policies

Once the cluster start to grow it is spiraling itself into a self-reinforced cycle of growth, especially when local industries and institutions are supportive and local competition is dynamic. According to Dicken the development is including[26]:

- Attraction of linked activities
- Stimulation of entrepreneurship and innovation
- Deepening and widening of the local labor market
- Economic diversification
- Enrichment of the "industrial atmosphere"

---

[23] Richard Florida, *Den kreativa klassens framväxt*, Göteborg, Daidalos, 2001, p. 268
[24] Ibid, p.295
[25] Michael E. Porter, *Clusters and the New Economics of Competition*, Harvard Business Review 1998, pp. 84-85
[26] Peter Dicken, *Global Shift, Mapping the contours of the changing world economy*, 5th Ed., London, Sage Publications, 2007. p. 23

- "Thickening" of local institutions
- Intensification of the socio-cultural milieu
- Enhanced physical infrastructures

Again, the cumulative nature of these processes implies the path dependent nature of clustering. However, a growing cluster signals opportunity. This in turn attracts talent and capital and the cluster continues its growth. Numerous studies suggest that it takes a decade or more for a cluster to develop real regional competitive advantage[27].

Porter, 1998, points out several reasons why clusters decline, both external and internal. One of the external reasons for decline is technological discontinuity, an unforeseen disruptive technology that rapidly changes the competition. The second is a shift in buyers' needs that creates a divergence between the local and global markets. Clusters also decline due to internal forces such as over consolidation, mutual understandings, cartels, and restraints to local competition or regulatory inflexibility. Groupthink is another internal reason for decline. It leads to inward looking and creates rigidity in an otherwise dynamic cluster. Over time, however, a location will decline if it fails to build capabilities in major new technologies or if it fails in creating the necessary supporting firms and institutions[28].

3.4 Innovation & Entrepreneurship

3.4.1 Origin of the terms

Josef Schumpeter is considered one of the main theorists on innovation. In his writings stating back to 1934, he wanted to disrupt the neoclassical view of economic life as something mainly passive, as he felt there was an energy driving change in the economy. This energy was according to Schumpeter innovation. For Schumpeter it was technological competition that drove economic development in the capitalist economy, in contrast to the classic views where economic development was based on price competition. In his first writings he attempted to define innovation, or development as it was called, as "new combinations of new or existing knowledge, resources, equipment

[27] Michael E. Porter, *Clusters and the New Economics of Competition*, Harvard Business Review 1998, p. 85
[28] Ibid, p. 85

and so on"[29] He also separated innovation from invention, innovation was something carried out in the economic sphere with a commercial function, whereas invention could occur anywhere without any intent to commercialization. Hence Schumpeter defined innovation as[30]:

"Innovations are novel combinations of knowledge, resources etc. subject to attempts at commercialization (or carried out in practice)."

He called the people making these novel combinations "entrepreneurs" and the activity they conducted "entrepreneurship".

3.4.2 The connection between innovation & entrepreneurship

This link between innovation and entrepreneurship is something that has lasted in theory. Peter F. Drucker, a thought leader in innovation, put it this way in his HBR article *The Discipline of Innovation*[31] originally published in 1985.

"Innovation is the specific function of entrepreneurship, whether in an existing business, a public service institution, or a new venture started by a lone individual in the family kitchen. It is the means by which the entrepreneur either creates new wealth-producing resources or endows existing resources with enhanced potential for creating wealth."

He argues that entrepreneurship does not refer to a special type of business, small or big, new or old but rather to a certain type of activity where innovation is the centerpiece. Thus, he defines innovation as:

"The effort to create purposeful focused change in an enterprise's economic or social potential."

There is much more to entrepreneurship than innovation, means Drucker, such as entrepreneurial management and entrepreneurial strategies. In the end though, entrepreneurship is fundamentally about systematic innovation, he concludes.

3.4.3 Modern definitions of innovation & entrepreneurship

In the *Ministerial report on the OECD Innovation Strategy Key Findings* from 2010 one can read the following definition of innovation[32], derived from the 3rd Edition of the Oslo Manual:

---

[29] Josef Schumpeter, *The Theory of Economic Development*, Cambridge, Mass. Harvard University Press, 1934, p. 65

[30] Jan Fagerberg, *A Guide to Schumpeter,* 2009, p.20

[31] Peter F. Drucker, *The Discipline of Innovation*, Harvard Business Review, 2002, p. 5

The implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.

OECD primarily refers to business innovation, but states clearly that considerations are being given to extend the definition also to innovation for social goals and public sector innovations.

[32] OECD, *Ministerial report on the OECD Innovation Strategy, Innovation to strengthen growth and adress global and social challenges, Key Findings,* OECD, 2010, p. 1

4. The Innovation Ecosystem Model

In this chapter the different models for understanding and analyzing a Regional Innovation System is described and combined into the specific framework used in this thesis, The Innovation Ecosystem Model. *The model has been applied according to the description in this section in order to fulfill the sub purpose of creating a theoretical framework for analyzing innovation clusters.*

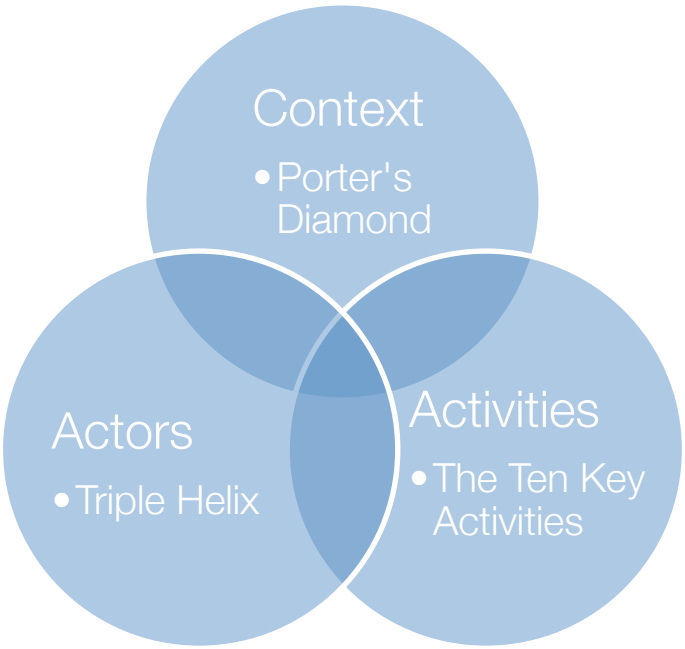


Figure 2: The Innovation Ecosystem Model

The Innovation Ecosystem Model, Figure 2, is a combination of different approaches and theories in cluster and SI- theory. The model was created in order to find a way to understand and compare different clusters. To use the model the Context is first mapped using Porter's Diamond, then the Actors are mapped into the Triple Helix model, lastly the Activities are mapped and sorted into the model using Edquist's Ten Key Activities framework. The three "sub-models" has been chosen, as they are well renowned frameworks for understanding and analyzing innovation clusters. The model gives a holistic view of a cluster and provides a structured framework for understanding and discussing similarities and differences between different clusters.

In this thesis the model has been applied as follows.

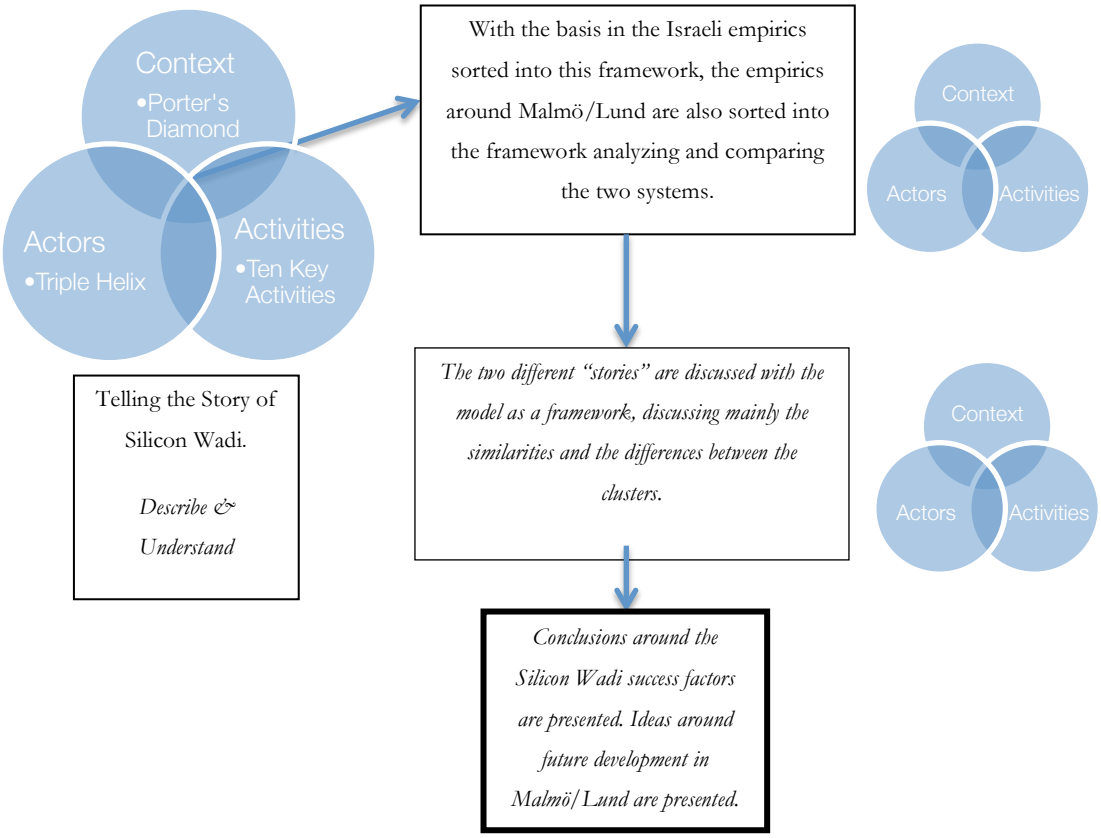


Figure 3: The Innovation Ecosystem Model as applied in this thesis.

4.1 Context – Porter's Diamond

Michael E. Porter, 1990, describes Competitive Advantage of Nations with the *Diamond Model*, known as Porter's Diamond.

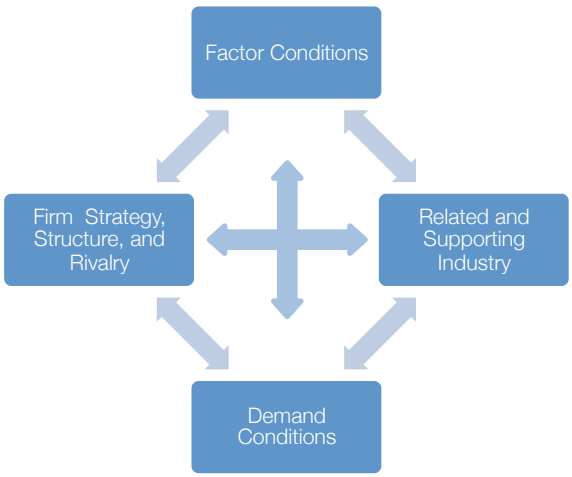


Figure 4: Porter's Diamond model

It consists of four main factors that create the national environment in which a company competes[33]:

1. **Factor Conditions:** The nation's position in factors of production, such as skilled labor or infrastructure, necessary to compete in a given industry.
2. **Demand Conditions:** The nature of

[33] Michael E. Porter, *The Competitive Advantage of Nations*, Harvard Business Review, 1990, p. 78

home-market demand for the industry's product or service.

3. **Related and Supporting Industries:** The presence or absence of supplier industries and other related industries that are internationally competitive.
4. **Firm Strategy, Structure and Rivalry:** The conditions in the nation governing how companies are created, organized, and managed, as well as the nature of domestic rivalry.

According to Porter a cluster works best when all the four facets are in place.

4.2 Actors – Triple Helix

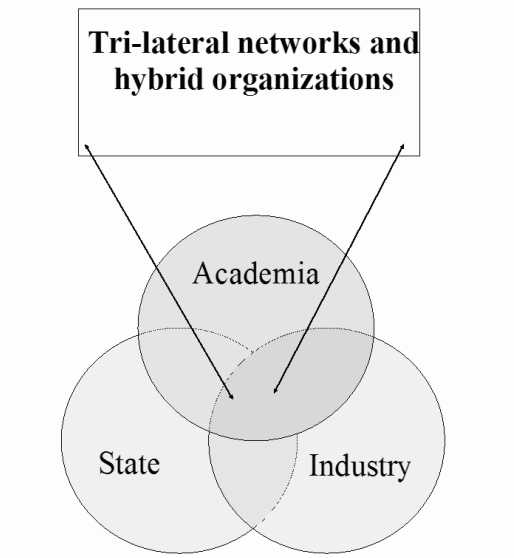


Figure 5: The Triple Helix III model by Leydesdorff. Source: http://www.leydesdorff.net/rp2000/index_files/image003.gif

The Triple Helix model is a model used to visualize the relations between different actors in an innovation system. The model takes different forms depending on cultural context. For this thesis the Triple Helix III model is used, as described by Etzkowitz and Leydesdorff (2000). The Triple Helix III model can be seen in Figure 5. The main actors are Academia, State and Industry. In the Triple Helix III model the actors intersect and hybrid organizations such as Technology Transfer Offices and trilateral strategic partnerships occur[34].

4.3 Activities – The Ten Key Activities

Edquist (2004) describes what actually takes place in a SI as *activities*[35]. The activities are the factors impacting the development, diffusion and use of innovation. Edquist lists ten important activities divided into four categories. These categories are: Knowledge inputs

[34] Henry Etzkowitz et al., *The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university–industry–government relations*, Research Policy 29, Elsevier. 2000, p. 111
[35] Charles Edquist, *Systems of Innovation, Perspectives and challenges*, The Oxford Handbook of Innovation, Oxford, Oxford University Press, 2006, p. 190

to the innovation process, Demand side factors, The provision of constituent of SIs, and Support services for innovating firms[36]:

Knowledge inputs to the innovation process:

1. Provision of Research and Development (R&D), creating new knowledge, primarily in engineering, medicine and the natural sciences.
2. Competence building (provision of education and training, creation of human capital, production and reproduction of skills, individual learning) in the labor force to be used in innovation and R&D activities.

Demand side factors:

3. Formation of new product markets.
4. Articulation of quality requirements emanating from the demand side with regard to new products.

Provision of constituents of SIs:

5. Creating and changing organizations needed for the development of new fields of innovation, e.g. enhancing entrepreneurship to create new firms and intrapreneurship to diversify existing firms, creating new research organizations, policy agencies, etc.
6. Networking through markets and other mechanisms, including interactive learning between different organizations (potentially) involved in the innovation processes. This implies integrating new knowledge elements developed in different spheres of the SI and coming from outside with elements already available in the innovating firms.
7. Creating and changing institutions – e.g. IPR laws, tax laws, environment and safety regulations, R&D investment routines etc. – that influence innovating organizations and innovation processes by providing incentives or obstacles to innovation.

[36] Charles Edquist, *Systems of Innovation, Perspectives and challenges*, The Oxford Handbook of Innovation, Oxford, Oxford University Press, 2006, p. 190

Support services for innovating firms:

8. Incubating activities, e.g. providing access to facilities, administrative support, etc. for new innovative efforts.
9. Financing of innovation processes and other activities that can facilitate commercialization of knowledge and its adoption.
10. Provision of consultancy services of relevance for innovation processes, e.g. technology transfer, commercial information, and legal advice.

5. The ICT Cluster in Israel´s Silicon Wadi

This chapter presents the empirical data around Silicon Wadi. The empirics describe the cluster from a number of perspectives and aims to give the reader a comprehensive understanding of the ICT cluster in Israel.

This chapter plays an important role in fulfilling the sub purpose to better understand the cluster in Silicon Wadi.

5.1 Defining Silicon Wadi

There are no clear definitions of the exact geographical borders of Silicon Wadi, however, de Fontenay et al., 2004, describes the cluster as having three main centers. These centers are located in the metropolitan areas of Tel Aviv, with the densest concentration of ICT-companies, Haifa and Jerusalem[37]. This indicates the cluster is stretching from Haifa to Tel Aviv and then inlands toward Jerusalem. The area of Silicon Wadi referred to in this thesis is the one drawn on the map in Figure 6.

5.1.1 Tel Aviv

Tel Aviv is the biggest city of the main three cities constituting Silicon Wadi. The Tel Aviv-Yafo metropolitan area accounts for approximately 3,2 million inhabitants, according to the CIA World Factbook, 2013.

The character of the city is vivid and full of life and it is often depicted as the city "that never stops". In later days Tel Aviv has become the main driver for the Israeli economy and many headquarters of Israeli companies are located here, as well as the Tel Aviv Stock Exchange, TASE.

5.1.2 Jerusalem

Jerusalem is the capital of Israel and the center for three world religions. Its population is approximately 770,000 people[38]. The city is not as vibrant and "always on" as Tel Aviv, and Tel Aviv also remains the financial center of Israel. The economy in Jerusalem builds

[37] Catherine de Fontenay et al., *Israel´s Silicon Wadi, The Forces Behind Cluster Formation,* Building High-Tech Clusters, Silicon Valley and Beyond, Cambridge, Cambridge University Press 2004, p. 42.
[38] CIA, *The World Factbook*, CIA, Application on Apple iPhone, 2013

much upon tourism, but there are some 180[39] high technology firms also located here. The city is home of the Israeli parliament, Knesset, and many of the Ministerial functions is placed in Jerusalem.

5.1.3 Haifa

Haifa is according to the city's own web page the "Capital of the North of Israel" with just above 1 million inhabitants[40]. The city is the principal port in Israel and has a long maritime history. The industry today is diverse and consists of everything from petroleum refineries to naval shipbuilding. It is also the home to many multinational companies such as IBM, Google, Microsoft, and Yahoo! and Intel. The city was, and still is, the host for the first Israeli university, Technion, that was built in 1912.

[39] Gil Zohar, *Bet Your Bottom Dollar,* The Jerusalem Post, 2007-06-28 http://web.archive.org/web/20080203230544/http://www.jpost.com/servlet/Satellite?cid=1182951036437&pagename=JPost/JPArticle/ShowFull, 2013-02-07

[40] CIA, *The World Factbook*, CIA, Application on Apple iPhone, 2013

Figure 6: Map of Israel showing Silicon Wadi. Adapted from the source at: http://www.americanprogress.org/wp-content/uploads/issues/2009/06/img/israel_map.gif

5.2 Israel and Silicon Wadi's Economic History

In order to understand what the business landscape looks like today it is important to understand the development cycles of the Israeli industry. According to Senor and Singer, 2009, the Israeli economy faced two major leaps in economic development, separated by periods of stagnation and inflation. The first leap occurred between 1948-1970, and the second leap between 1990 up until today[41].

The first period of economic growth and development took place much due to a pragmatic government. The government invested heavily in infrastructure projects and was also highly involved in creating new industries in Israel through different active

[41] Dan Senor et al., *Start-up Nation, The Story of Israel´s Economic Miracle,* New York, Hachette Book Group, 2009, p. 103

measures. With the rise of the Yom-Kippur war in 1973 the industry came to a halt and a period of stagnation commenced.

During the 1980's a period of hyperinflation began. At this time the Bank of Israel had a monopoly in the capital markets and tried to cut inflation through indexing, linking e.g. rents, wages and prices to a Consumer Price Index. Though trying to curb inflation, this rather reinforced the inflation cycle.

The turn came in 1985 when then finance minister Shimon Peres took austerity measures in order to stifle inflation. This was followed by a wave of privatization and initiatives trying to attract Venture Capital, VC, to Israel. Another initiative, and one of the most important ones, according to Senor and Singer, 2009, was the governmental VC fund Yozma.

Broadly one can say the Israeli economy has gone from an economy with a high grade of governmental interventions to a more market oriented economy with a lower grade of governmental interventions.

To get a more detailed view of the economic phases that lead to the creation of Israel's ICT cluster Harel and Avnimelech, 2012, divide the economic development into five phases, ranging from 1969-2008[42]:

1. The Background Conditions Phase – 1969-1986
2. The Pre-Emergence Phase – 1986-1992
3. The Emergence Phase – 1993-2000
4. The Crisis Phase – 2001-2003
5. The Post-Emergence Phase – 2004-2008

These phases are described more in detail in Appendix 1.

5.3 Organizations in Silicon Wadi

The organizations in the Israeli cluster are mainly divided into three broad categories, government, firms and universities.

[42] Gil Avnimelech et al., *Global venture capital 'hotspots': Israel,* Handbook of research on venture capital, Volume 2, Cheltenham, Edward Elgar Publishing, 2012, p. 211

5.3.1 Government

Most of the governmental support and interventions to support innovation activities in Israel are organized under the Ministry of Industry Trade and Labor, MOITAL. One instance under MOITAL is of particular importance, the Office of Chief Scientist, OCS. Another organization under MOITAL is Invest in Israel, promoting the Israeli high-tech industry to international investors and companies. Different government decisions, laws and policies have deliberately created these instances.

5.3.1.1 Important Government Policies and Programs

Alongside the development in the five phases, the government has been implementing more or less successful policy programs. According to Harel and Avnimelech, 2012, the ones created to directly spur the ICT industry were Inbal, Yozma, Magnet and the Technological Incubator Program[43]. Other important instruments in the development of the Innovation and Technology Policy, ITP, has been LECI, Law for the Encouragement of Capital Investments, OCS, Office of the Chief Scientist, BIRD, Binational Industrial R&D and LEIRD, Law for the Encouragement of Industrial R&D. These initiatives are described in detail in Appendix 2. Latter initiatives related to the ITP can be found under the fifth development phase in Appendix 1.

- Law of Encouragement of Capital Investments, LECI – 1959-
  Selected companies gained access to governmental grants and/or tax benefits.
- Office of the Chief Scientist, OCS – 1969-
  The public body responsible for overseeing all government sponsored R&D in the Israeli industry. OCS is also active in enacting policies around innovation and R&D.
- Bilateral Industrial Research and Development, BIRD – 1977-
  Program initiated to foster closer collaboration between American and Israeli firms.
- Law of Encouragement of Industrial Research and Development, LEIRD – 1984-
  The primary framework for all governmental support and intervention in industrial R&D.

[43] Gil Avnimelech et al., *Global venture capital 'hotspots': Israel,* Handbook of research on venture capital, Volume 2, Cheltenham, Edward Elgar Publishing, 2012, p. 216

- Inbal – 1992-1998

  A government owned insurance company with a focus on protecting VC-investments from risk.

- Yozma – 1993-1998

  Public-private co-funding program initiated to create a VC-market in Israel.

- Magnet Program – 1992-

  A program initiated to foster more collaboration between industry and academia.

- Technological Incubator Program – 1992-

  The incubator program provides newly started companies with office space, business advice and seed funding.

5.3.1.2 The Governmental Programs and Policies Mapped Towards GDP

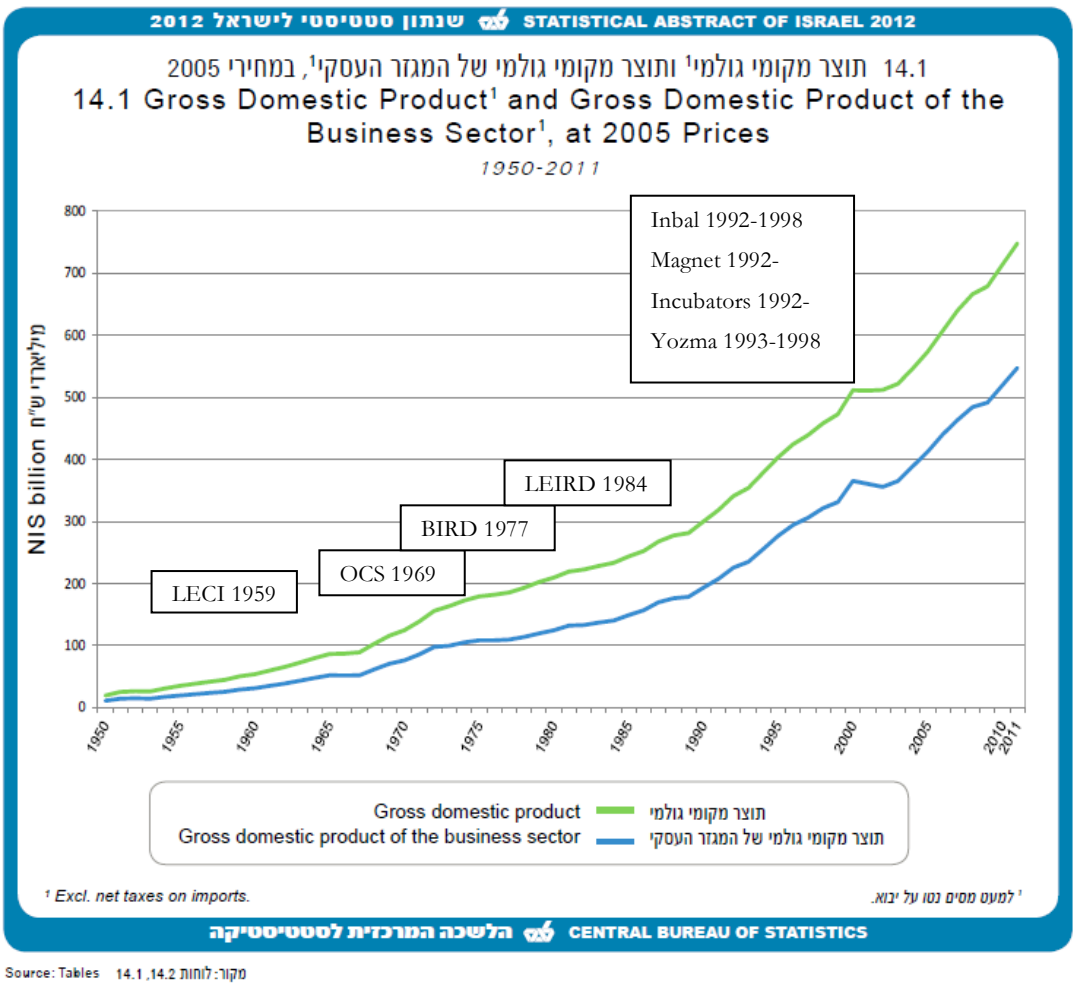


Figure 7: The different governmental programs and policies mapped towards the GDP development in Israel. Source: http://www1.cbs.gov.il/shnaton63/diag/14_01.pdf

5.3.2 Universities

Early on the Israeli government realized that for a small country with very limited natural resources human capital was to be the most important asset. The first university to be established in the country was Technion, or Israel Institute of Technology as it is also called, in 1912. Today there are seven public universities in Israel, six of them within the Silicon Wadi area. These are Bar-Ilan University, Hebrew University, Israel Institute of Technology – Technion, Tel Aviv University, University of Haifa and Weizmann Institute, each of them described more in detail in Appendix 3. Beyond the seven public universities there are also The Open University in Tel Aviv with mainly distance studies online and open admissions, as well as the many regional and academic colleges in the country.

The Israeli population is generally well educated with an attainment of tertiary education of 44,9 % of the population, ages 25-84 years[44] according to OECD.

5.3.2.1 University Rankings

According to the Shanghai Ranking, ARWU, Academic Ranking of World Universities the Israeli Universities are ranked as follows[1]:

53. The Hebrew University of Jerusalem

78. Israel Institute of Technology, Technion

93. Weizmann Institute

101-150. Tel Aviv University

301-400. Bar-Ilan University

The Swedish universities in Malmö/Lund are ranked as follows:

101-150. Lund University

5.3.3 Technology Transfer Offices

Closely related to the Universities are the Technology Transfer Offices, TTO. The TTO's are instances responsible for diffusion of knowledge, R&D and innovation from

[44] OECD Country Statistical Profile: Israel, http://www.oecd-ilibrary.org/economics/country-statistical-profile-israel_20752288-table-isr, 2012-12-18

academia to the business sector. All of the six Silicon Wadi universities have a TTO. With the early realization of Israel's main asset as knowledge, the emphasis on commercializing the knowledge has been institutionalized into TTO's.

In Israel the universities role in creating novel technological solutions suitable for innovation has been ranked high. This has been clearly stated in the programs described under the section "*Important Government Policies and Programs*", where especially the Magnet program with its descendants, has played an instrumental role. The TTO's plays another integral role in commercializing the inventions, R&D and know-how created at the universities. The TTO's at the different Silicon Wadi universities are[45]:

- Bar-Ilan R&D at the Bar-Ilan University
- Yizzum Technology Transfer at the Hebrew University of Jerusalem
- T3 at Technion Israel Institute of Technology
- Ramot at Tel Aviv University
- Carmel Haifa University Economic Corporation at the University of Haifa
- Yeda R&D at the Weizmann Institute

The TTO's are companies owned by the universities and they are fully independent. They differ in size, profitability, tradition, and business models but share the goal to commercialize inventions and generate income to the universities[46]. They are for-profit companies and operate outside of the university organization. Most of them use commercialization strategies such as licensing, creating university spin-off companies, joint ventures and collaborative research between academia and industry. In addition some universities also invest in the spin-off companies. The spin-off companies usually license the technology to a startup entrepreneur that further develops the company and tries to attract capital investments. The researchers are seldom involved in the management of the company and in the commercialization, but rather work as expert consultants or at non-managerial positions over a limited time period[47].

Further on the TTO's provide researchers with an array of services. The services often provided are e.g. evaluation of the invention and its commercial viability and potential,

---

[45] Dominika Nowak, *National Innovation Systems – evidence from Israel*, Scientific Problems of Machines Operation and Maintenance, 2011, p. 124
[46] Ibid, p. 124
[47] Ibid, p. 124

patentability checks, and guidance through the patent process. The incentive schemes are often set up as such as the inventor derives 30-60 % of the royalty payments[48].

5.3.4 Firms

When it comes to commercialization of R&D, inventions and know-how firms plays an integral role as a commercial entity in the cluster.

In Israel's economy the technology industry has been the driving force behind the developments in later years[49]. In 2009 the product of ICT amounted to $19 billion. The sector employed 204,000 people and contributed 17.3 % of GDP. The exports, from this sector were close to $16 billion[50].

The concentration of high tech firms in Israel is very high, second only to Silicon Valley. Furthermore, the country is a world leader in startups that contribute more to GDP than any other country[51]. Small companies and startup companies are considered the cornerstone of innovation, as opposed to many other countries where innovation mainly takes place in large corporations[52]. According to Milken Institute (2005) 97 % of all Israeli firms are small businesses. Small businesses are here defined as companies with an annual turnover less than $5 million and with 50 or fewer employees[53].

Except from the startups there is also another significant component in the cluster in Silicon Wadi, namely the R&D facilities in Israel run by multinationals such as Cisco, IBM, Intel, Microsoft and QUALCOMM[54]. These foreign companies are important when it comes to acquiring the smaller innovative firms, opening up the world market as well as in providing funding for small innovative companies[55].

---

[48] Dominika Nowak, *National Innovation Systems – evidence from Israel*, Scientific Problems of Machines Operation and Maintenance, 2011, p. 125
[49] BDO Israel, *Doing Business in Israel 2010*, 2010, p. 21
[50] Israel Ministry of Foreign Affairs, *Economy: Sectors of the Israeli economy*, 2010-11-28, http://www.mfa.gov.il/mfa/aboutisrael/economy/pages/economy-%20sectors%20of%20the%20economy.aspx, 2013-01-17
[51] Soumitra Dutta et al., *Israel: Factors in the emergence of an ICT powerhouse*, The Global Technology Report 2005-2006, Palgrave MacMillan, 2006, p. 12
[52] Dominika Nowak, *National Innovation Systems – evidence from Israel*, Scientific Problems of Machines Operation and Maintenance, 2011, p. 118
[53] Glenn Yago, *Building Israel's Small Business and Microenterprise Sector*, Milken Institute, 2005, p. 14
[54] Soumitra Dutta et al., *Israel: Factors in the emergence of an ICT powerhouse*, The Global Technology Report 2005-2006, Palgrave MacMillan, 2006, p. 8
[55] Dominika Nowak, *National Innovation Systems – evidence from Israel*, Scientific Problems of Machines Operation and Maintenance, 2011, p. 118

De Fontenay et al. (2004) means that because of the small domestic market and the relative low amount of early adopting consumers the Israeli technology sector firms often sells their sophisticated technology products to advanced business customers. The general weakness in areas such as marketing and user interface design is due to this phenomenon the relative lack of end customers on a huge home market. Still in these days, the problem is accentuated by Saul Klein of Index Ventures. In a 2011 interview with Wired, the world-renowned technology magazine, he states that Israel in general has great developers, but lack of knowledge in distribution and design[56].

The legal entities in Israel are companies, partnerships, cooperatives and non-profit organizations.

Companies are the most common legal entity and can take the form of private, public and foreign company. Partnerships are divided into General Partnership and Limited Partnership.

5.3.5 Venture Capital Organizations

In creating a successful milieu for innovative ICT startup companies there are two main ingredients, technological creativity and a sufficient flow of venture capital[57]. VC generally comes from three sources[58]:

- Business Angels – Successful entrepreneurs and businessmen investing their own money into primarily early stage ventures.
- Venture Capital Firms – Investors choosing their investments based on financial returns, have a general time horizon of three to seven years and can be involved in all stages of financing.
- Corporate Venturing Units – Parts of larger corporations that seek to fund projects and companies that produce financial returns. Often these investments are being made in companies aligning with the larger corporation's strategic direction.

[56] David Baker, *Europe's hottest startup capitals: Tel Aviv*, Wired, 2011-08-15, http://www.wired.co.uk/magazine/archive/2011/09/european-startups/tel-aviv?page=all, 2013-01-18
[57] Soumitra Dutta et al., *Israel: Factors in the emergence of an ICT powerhouse*, The Global Technology Report 2005-2006, Palgrave MacMillan, 2006, p. 12
[58] Sarah Lidé, *Öresund: A Free Port for Knowledge*, PwC, 2011 pp. 32-33

The VC-firms are of particular importance in the Israeli innovation system. In 1990 there were only two VC-funds managing in total $59 million[59]. The Yozma program, described in the section *Important Government Policies and Programs* and in Appendix 2*,* initiated in 1993 was a well-needed initiative from the government and became one of the most significant instruments in the establishment of a VC industry in Israel. According to Senor et al. there were in 2009 45 domestic VC-funds in Israel[60]. The organization Invest in Israel under the Ministry of Industry, Trade and Labor states on their web page that today there are approximately 70 active VC-funds in Israel. 14 of these funds are international funds with offices in Israel. The numbers also suggests that 546 Israeli companies in 2011 raised $2.14 billion, an increase of around 70 % from 2010 when Israeli companies raised $1.26 billion. Additionally there are about 220 international VC-funds that do not have offices in Israel, but actively invest in Israeli companies[61]. The relations with multinationals have been of utter importance in the role of providing a way of exit for venture capital[62].

According to World Economic Forum, 2006, Israeli high-technology companies attracted more capital than any country in Europe did during 2004. The main industries invested in are software, network and communications technology. Furthermore, VC investments contributed a 40 % increase in GDP during the years of 1995-2004[63].

Returning to Harel's and Avnimelech's, 2012, five phases of the development of the ICT cluster in Israel, the VC development looks like following, the background phase not included[64]:

---

[59] Soumitra Dutta et al., *Israel: Factors in the emergence of an ICT powerhouse*, The Global Technology Report 2005-2006, Palgrave MacMillan, 2006, p. 12
[60] Dan Senor et al., *Start-up Nation, The Story of Israel´s Economic Miracle,* New York, Hachette Book Group, 2009, p. 169
[61] Invest in Israel, *Venture Capital in Israel,* http://www.investinisrael.gov.il/NR/exeres/A19A138D-87A7-416B-8D62-1C968E035E13.htm, 2013-01-21
[62] Soumitra Dutta et al., *Israel: Factors in the emergence of an ICT powerhouse*, The Global Technology Report 2005-2006, Palgrave MacMillan, 2006, p. 13
[63] Ibid, p. 12
[64] Gil Avnimelech et al., *Global venture capital 'hotspots': Israel,* Handbook of research on venture capital, Volume 2, Cheltenham, Edward Elgar Publishing, 2012, p. 215

	1990-92 Pre-emergence	1993-2000 Emergence	2001-2003 Crisis	2004-2008 Mature
Israeli VC's established	2.7	13.4	8.3	10.4
Israeli VC fundraised ($ million)	395.8	763.4	610.3	951.9

Adding to these numbers are the wide array of international investors and VC funds investing in Israeli companies.

5.3.5.1 Trends in the Israeli VC industry

The Israeli and global VC industry has been suffering during 2009-2010 much due to the turbulence following the US sub-prime crisis. Furthermore, the VC funds have been facing low returns during the last years. Harel and Avnimelech, 2012, outline a few trends for the VC industry in Israel with these background facts in mind. First and foremost entrepreneurs and startup companies will have to rely more on so called bootstrapping, funding the company with the founders own capital, with the company's own revenue, and on small amounts of external capital. The authors further describe mainly three models that might be suitable for the future VC market in Israel[65].

The first is the growing occurrence of Angels, Super Angels and Angel Groups. The number of angel investors, but also a few super angels, seems to be growing due to the higher density of wealthy, entrepreneurially experienced individuals in Israel. Angel groups are emerging and examples of such are Startup Factory, Proxima, Arbel Capital and TechAviv. These people, and groups of people, can themselves screen the market for startups and then inject much needed competence and small amounts of money into these companies. Moreover, the software, mobile and internet companies does often not need the extensive amounts of money a VC offers and are hence suitable for angel investments.

The second trend is the changing nature of incubators. Still focused on early stage startup companies the change lies within the ownership of the incubator. Some of the most

[65] Gil Avnimelech et al., *Global venture capital 'hotspots': Israel,* Handbook of research on venture capital, Volume 2, Cheltenham, Edward Elgar Publishing, 2012, pp. 220-223.

successful incubators in Israel, such as Maayan Ventures and Xenia are traded publicly. The performance of these incubators is so far good, but with the experience from publicly traded VC funds, publicly traded VC companies seem to perform worse than the industry on average.

The third trend is the micro-VC companies. These companies act in industries where the amount of money invested is lower than for a typical VC, with investment amounts of around $100,000 to $250,000. In the environment where these companies function, there are often severe time-to-market constraints and therefore a faster investment process is needed. The funds typically manage around $20-$30 million and examples of such micro-VC's are Kima Ventures and Lool Ventures.

5.3.6 Technology Incubators

The incubators help companies through the early stages, were they are too risky for private capital investments. The OCS has stated that an incubator should be its own legal entity, for profit. Further on they should support startup companies with a physical work environment, administrative services, technological and business guidance, financing, and connections to potential partners, investors and customers.

There are today 26[66] technological incubators in Israel. Out of these, the ones in this section are active within Telecom, Internet and Media. Particularly interesting incubators on the list are the ones dedicated to ICT and media only and incubators located in Silicon Wadi. These are as following:

- Explore
- JVP Media Studio
- The Time Innovation Ltd

The other incubators are more general and have a broader focus. Worth taking into consideration are also the incubators with more than ten ICT-related companies in their portfolio. These are:

- Granot Ventures – 14 ICT companies in their portfolio
- Xenia Venture Capital Ltd (TASE) – 11 ICT companies in their portfolio

[66] Technological Incubator Program, http://www.incubators.org.il/category.aspx?id=606, 2012-10-18

Beyond these incubators there are 21 more. They are focusing on other fields, such as medical devices, life science and clean tech and/or are located outside Silicon Wadi, hence outside the delimitations of this thesis.

All these incubators invest in the companies that they decide to work with. In order to get funded and to get accepted into an incubator there are rigid application processes in place. The process often include a due diligence process where the incubator's investors are examining the company and its business idea. In the end of the process the OCS have to finally approve the applicant. First after this approval the company is invested in and becomes an incubator company. The invested money mainly comes from the OCS, 85 %, but also from the incubator providing 15 %[67].

From the 26 incubators in Israel five are described below. They were chosen according to the criterion stated above. Either wholly focused on ICT and Media or having more than ten ICT/Media startups in their portfolio.

5.3.6.1 Explore

Explore, also called Explore. Dream. Discover., is situated right outside the city of Haifa and is a pre-seed and seed investment group focusing on Internet, Cellular and New Media ventures.

Explore was founded in 1999 and provide entrepreneurs with initial investments up to $500.000, active board membership, advices in strategy and business development etc. The incubator is jointly owned by two early stage investment entities, Plus Ventures and 2B Angels[68]. Today Explore holds six companies in its portfolio.

5.3.6.2 JVP Media Studio LP

JVP (Jerusalem Venture Partners) Media Studio is the early stage investment arm of JVP. JVP Media Studio is situated in Jerusalem and invests in seed-stage startup companies. The focus of the incubator is new media, enterprise software, mobile Internet, gaming and advertising. According to its web page the incubator's mission is to provide a suite of customized services, including seed financing, hands-on management, office space and strategic guidance. The team working at the JVP Media Studio is composed of

[67] Technological Incubator Program, http://www.incubators.org.il/category.aspx?id=606, 2013-01-22
[68] Explore, About us, http://www.iexplore.co.il/index.php/about, 2012-10-18

knowledgeable people in the fields of business, technology and media[69]. Today JVP holds ten companies and invests up to $1.5 million in the companies chosen for investment[70]. The incubator was founded in 2003.

5.3.6.3 thetime Innovation Ltd

thetime is an incubator located in Tel Aviv and it was founded in 1992. The incubator invests, usually an initial sum of $500-$1 million, in new companies, developing digital products or services that can be distributed through digital channels or over the web. The incubator has 25 companies in its portfolio, which makes it the largest ICT incubator in Israel today. It has also been selected as Israel's best incubator both 2010 and 2011, the selection was made by the OCS[71].

thetime have a strong partner network, including global advertising agencies as well as media, telecom and entertainment giants such as Time-Warner, Nielsen, Microsoft, Orange, Sony and Celldorado[72].

5.3.6.4 Granot Ventures Ltd

Granot Ventures acquired the Yozmot Incubator in 2008, changing the name to Granot Ventures Incubator. The incubator was first established in 1992.

The incubator invests in technology companies at different stages of development and is located between Tel Aviv and Haifa. The portfolio today consists of, among others, 14 ICT-companies. The offering from the incubator is business development, fundraising networking etc.[73].

5.3.6.5 Xenia Venture Capital Ltd (TASE)

Xenia Venture Capital differs from the incubators mentioned above as it is publicly traded on the Tel Aviv Stock Exchange (TASE). The incubator is focused on start-up companies within the fields of Information Technology and Medical Devices. The incubator has partners in both Israel and the US.

---

[69] About JVP Medialabs, http://www.jvpvc.com/medialabs-about, 2012-10-18
[70] Technological Incubator Program: JVP Media Studio, http://www.incubators.org.il/incubator.aspx?id=1370&catid=576, 2013-01-21
[71] thetime, http://www.thetime.co.il/, 2013-01-22
[72] thetime, About, http://thetime.co.il/about-us/overview.aspx, 2012-10-18
[73] Granot Ventures, http://www.granot-ventures.com/, 2012-10-18

Since it was founded in 2003 Xenia has invested in 26 companies. The investments have been mostly successful and resulted in substantial value increases. Today the incubator has eleven ICT companies in its investment portfolio[74].

5.4 Culture

In a radio program broadcasted by Swedish Radio 2013-01-20[75], Yossi Vardi, by many called the "Godfather" of Israeli tech-companies, expressed his view of why Israel has become such an international success within technology and innovation. He means it is not only because of technology, education, government support or the army. It is mostly because of the Jewish mother. By that he means the special cultural Jewish traits, or even, as he puts it, the cultural defects expressed when a Jewish mother tells her seven year old son: *"After all what we have done for you, asking for one Nobel prize is really too much?"*

Besides all the technological explanations, governmental interventions and high levels of venture capital, the cultural traits of Israelis are often cited as an important factor in building the Israeli high technology industry. Hence, this aspect is also examined in this thesis.

5.4.1 Diaspora

Diaspora is a Greek word meaning scattered dispersion and refers to the movement, migration or scattering of a people away from their homeland. The diaspora Jews coming back to Israel from all over the world has made the country tremendously internationally interconnected. This international network has been of growing importance in an increasingly globalized world. During later years an ever-growing stream of immigrants has further accentuated and increased the international presence in Israel.

The returning Jews have been an instrumental factor in the establishment of the R&D centers of multinational companies. Dov Frohman is one example when he, in 1974, persuaded Intel's management to open up an R&D center in Haifa[76], the first Intel research center outside the US. Another example is Michael Laor. Michael Laor moved from Israel to California to work for Cisco. In 1997 he decided to move back to Israel.

---

[74] Xenia, About Us, http://xenia.co.il/AboutUs, 2013-01-21
[75] Sveriges Radio, http://sverigesradio.se/sida/artikel.aspx?programid=438&artikel=5414150, 2013-01-21
[76] Dan Senor et al., *Start-up Nation, The Story of Israel´s Economic Miracle,* New York, Hachette Book Group, 2009, p. 152

The Cisco management team then decided to give him the responsibility to open up their first foreign R&D center[77].

5.4.2 The Military's Impact on Israeli Work Culture

The mandatory military service in Israel is as well often referred to as an important shaper of the Israeli culture. De Fontenay and Carmel, 2004, mean that the military forces both males and females to shoulder a lot of responsibility at a young age, acting in flat organizations, with a clear but very informal hierarchy where challenging and communicating opinions to superiors are encouraged. Senor and Singer, 2009, describe the continuous challenging and the open debate as Chutzpah, an Israeli cultural trait that translates into something like audacity or fearless daring[78]. Further on, the military service teach young Israelis to work long hours, to respond quickly to arising issues, to be flexible, to do whatever it takes to complete a task and to think of the strategic objectives rather than the specific job description[79].

The vast leadership responsibilities shouldered by those in leadership positions and the cutting edge engineering skills taught to young bright engineers in the elite forces are important factors in building knowledge much needed also in business. The focus on collaboration and teamwork fosters both an understanding and an ease of working in teams as well as strong networks. These relational networks are important also in the civilian life[80].

The military organizational schemes and values are reflected in the society overall. The value neutral treatment of performance for example, is another cultural attribute that is reinforced by the army's way of treating success or failure. As long as you have learnt from your failures, even the failures are a success. There is less focus on the outcome of ones decisions, than on the lessons one learnt or on the process leading up to that decision. There are also other ways that the military culture is reflected in society. According to Senor and Singer, 2009, there is less focus on rank than performance, Israel is an informal society, flat organizations with very low hierarchy are common in Israel,

---

[77] Dan Senor et al., *Start-up Nation, The Story of Israel´s Economic Miracle,* New York, Hachette Book Group, 2009, p. 136
[78] Ibid, p. 31
[79] Catherine de Fontenay et al., *Israel´s Silicon Wadi, The Forces Behind Cluster Formation,* Building High-Tech Clusters, Silicon Valley and Beyond, Cambridge, Cambridge University Press 2004, p. 51
[80] Soumitra Dutta et al., *Israel: Factors in the emergence of an ICT powerhouse*, The Global Technology Report 2005-2006, Palgrave MacMillan, 2006, p. 4

and there is an ongoing questioning, challenging and debate also around leaders. Further on, the experimental nature of the military service, where every day is seen as an experiment finished off with long debriefings, is applicable also on creating innovative startup companies. Eric Ries, as made famous by his best-selling book The Lean Startup, 2011, argues that a startup company needs to create hypotheses, experiment and act on them and lastly reflect and learn from the experiments. First when an entrepreneur does this, a technology startup can be successful[81].

5.4.3 Collective Values

According to de Fontenay and Carmel, 2004, the Israeli culture is built on collective values, derived from the socialistic roots of the country, and the notion of a shared identity and a shared purpose. Once again, the military service is an important institution in creating these collective values where soldiers at an early age are encouraged in creating a strong loyalty to their fellows and to the group. According to the authors the collective values are manifested in technology companies in mainly two ways. First, Israelis are generally accustomed to work in teams and secondly, there is a tremendous loyalty towards the firm, seen in the low turnover rates in Israeli high tech companies[82].

Senor and Singer, 2009, also argue that the Kibbutz, communities built around collectively owned farmland, has been important in creating the collective values and to foster entrepreneurship in Israel. At the Kibbutz everyone work together to solve a problem. On such problem was how to create efficient irrigation systems in the desert. The solution to this particular problem has resulted in the world leading drip irrigation firm Netafim[83].

Moreover the authors describe the Israeli culture as rather contradictory. While scoring high on collectivism the Israelis are also highly individualistic. A peculiarity they attribute, once again, the army in which you have to solve complex tasks. The only way to do it is to work as a team, a team where the individualistic people need to work together for the best of the group[84].

---

[81] Eric Ries, *The Lean Startup,* New York, Crown Publishing Group, 2011, p. 57
[82] Catherine de Fontenay et al., *Israel´s Silicon Wadi, The Forces Behind Cluster Formation,* Building High-Tech Clusters, Silicon Valley and Beyond, Cambridge, Cambridge University Press 2004, p. 52
[83] Dan Senor et al., *Start-up Nation, The Story of Israel´s Economic Miracle,* New York, Hachette Book Group, 2009, p. 63
[84] Ibid, p. 231

6. The ICT Cluster in the Malmö/Lund Region

This chapter aims to compile the empirics and give the reader a background of the innovation and business environment in Malmö and Lund. The cluster is described from different perspectives, the same as in the study of Silicon Wadi, and the main findings around challenges and opportunities derived from OECD's territorial review from 2012 are integrated.

6.1 Defining the Region of Malmö/Lund

The Malmö/Lund region is a smaller region within the larger Skåne-region of Southern Sweden outlined on the map in Figure 8 below. It has strong research facilities and a beneficial geographical location in the center of the expanding Öresund region.

Figure 8: Map of Sweden and map of Skåne. Adapted from sources:
http://www.lansstyrelsen.se/skane/SiteCollectionImages/Sv/om-lansstyrelsen/om-lanet/Skane_416.png
OECD (2012), OECD Territorial Reviews: Skåne, Sweden 2012, OECD Publishing.
http://dx.doi.org/10.1787/9789264177741-en

6.1.1 Malmö

Malmö is Sweden's third city and has about 300, 000 inhabitants[85]. The city has been going through a notable transformation during the later years. Malmö used to be an industrial city, so when the industry declined during the eighties and nineties the city followed. With the building of the Öresund bridge and the establishment of Malmö University in the early 2000's the city's transformation started. Malmö became connected with Copenhagen and knowledge intense companies are now established in the city as well as an array of multinational companies.

With MINC and Media Evolution City, incubators and office spaces for media companies and ICT startups, the local politicians have decided to invest in the startup culture in the city. The initiatives have paid off and small innovative companies are popping up at an increasing pace.

Still though, the city faces major challenges with segregation on the local housing market as well as on the regional labor market.

6.1.2 Lund

Lund is an old university town in southern Sweden, located just 15 kilometers from Malmö. The city has about 112,000[86] inhabitants (2011). The city is famous for its well renowned university, Lund University that was established in 1666 and today has around 50,000 students from all over the world[87].

The city is also well known for its science park Ideon, with multinationals, startups and incubators working in an innovative milieu. Famous companies growing up in the university and Ideon soil have been Axis, world leader in network video and Scalado, a mobile imaging company acquired in 2012 by Nokia.

6.2 Organizations in Malmö/Lund

There are numerous organizations in the regional cluster in Malmö/Lund.

---

[85] The city of Malmö, http://malmo.se/english, 2013-02-07
[86] The City of Lund, Statistics, http://www.lund.se/Medborgare/Kommun--politik/Kommunfakta/Statistik/Befolkning/, 2013-02-07
[87] Lund University, Short Facts, http://www.lu.se/om-universitetet/universitetet-i-korthet, 2013-02-07

6.2.2 Government

The Malmö/Lund region is affected both by the national government initiatives around innovation and R&D policy as well as by the regional body, Region Skåne's policies and initiatives. Beyond this, the municipalities of Lund and Malmö also affect the business and innovation environment through their local political influence.

6.2.2.1 Skåne Regional Council – Region Skåne

Region Skåne is the self-governing authority of Skåne, the province in which Malmö and Lund are situated. Region Skåne is responsible for healthcare and medical services, public transportation, culture, cross border cooperation and regional growth and development[88] and has their headquarters in Malmö. Region Skåne is according to their web page the main driving and unifying organization when it comes to regional development in Skåne. They work within many different sectors such as cultural development, collaboration with EU, health and medical care, business and economic development, and marketing of Skåne[89]. The latter two further developed below.

6.2.2.1.1 Business and Economic Development[90]

The business and economic development has one major goal, to strengthen the business sector in Skåne together with private and public actors. Their work is divided into three units, Innovation System, Entrepreneurship and Business Development.

Innovation System refers to the work around commercializing services and products stemming from R&D. It is also closely linked to the efforts put down to reach the goal of Skåne as the world leader in regional innovativeness in 2020. One of the main strategies to reach this goal is to further develop the clusters in Skåne. According to Region Skåne the most important clusters in the Region are within ICT, Life Science, Food Science and Moving Images.

Entrepreneurship refers to the activities being done in order to foster and to increase entrepreneurial activities in Skåne as well as to the overall strengthening of the competitiveness of Skåne's companies. Their most important focus area is how to reap

---

[88] Skåne Regional Council, http://www.skane.se/sv/Webbplatser/skanese/English/, 2013-02-26
[89] Skåne Regional Council, Development of Skåne, http://www.skane.se/sv/Skanes-utveckling/Ansvarsomraden/, 2013-02-28
[90] Skåne Regional Council, Business and Economic Development, http://www.skane.se/sv/Skanes-utveckling/Ansvarsomraden/Naringsliv__investeringar/, 2013-02-28

the full benefits of the establishment of the world-class research centers ESS and Max IV in the region.

Business Development is the unit working with establishing routines, processes, and methods for businesses in Skåne. Examples of what is being done are programs such as *Rapid Growth Companies, Product Development, Export Programs* etc., containing for example seminars on the different topics.

6.2.2.1.2 Marketing of Skåne[91]

Business Region Skåne is a part of Region Skåne with the mission to promote Skåne within four distinct areas. These areas are represented in different suborganizations, Invest in Skåne, Film in Skåne, Tourism in Skåne and Event in Skåne. Invest in Skåne wants to promote investments opportunities in the region through strategic alliances and networks with international actors. The goal is to increase the influx of capital in the region and at the same time also promote export.

6.2.2.2 Municipality of Lund and Municipality of Malmö

The municipalities are local political bodies within Region Skåne. They are responsible for a wide array of organizations and activities within infrastructure, education and social work. They are also involved in trying to create a thriving business and innovation environment.

6.2.2.3 VINNOVA

VINNOVA is the main governmental authority in Sweden with the mission to foster innovation and to support needs-driven research. VINNOVA's vision *is for Sweden to be a world-leading country in research and innovation, an attractive place in which to invest and conduct business*[92].

VINNOVA promotes collaborations between companies, universities, research institutes and the public sector. This is done by stimulating a greater use of research, by developing catalytic meeting places and by making long-term investment in strong research and innovation milieus. VINNOVA also strives to strengthen international cooperation and

[91] Skåne Regional Council, Marketing of Skåne, http://www.skane.se/sv/Skanes-utveckling/Ansvarsomraden/Marknadsforing-av-Skane/, 2013-02-28
[92] VINNOVA, About, http://www.vinnova.se/en/About-VINNOVA/, 2013-02-26

to further develop bonds with other research financiers and organizations promoting innovation.

Every year VINNOVA invests about SEK 2 billion[93] in various initiatives. The investments made by VINNOVA must have a private counterpart investing at least the same amount as the authority.

6.2.2.4 Teknopol

Teknopol is an organization fully owned by Region Skåne. The organization's mission is to provide startup companies with advice on HR, IPR, and finance from experienced entrepreneurs. Under the organization a number of other organizations exist. Mobile Height Business Center – MHBC is the main initiative within the ICT industry. MHBC is an advisor on mainly telecom and mobile located in Lund. They brand themselves as a strong and creative mobile community[94].

There are as well other projects running under Teknopol, but the description of these are vague and it is difficult to find out what their main purpose and activities are.

6.2.2.5 Almi[95]

Almi is a public organization providing entrepreneurs with high-risk loans, venture capital investments and advisory services for entrepreneurs. Almi's role is to complete the capital market without competing with private initiatives on the market. At the end of 2012 it was announced by the government that Almi and Innovationsbron would merge into one company.

The high-risk loans are said to complete the loan market and they are granted entrepreneurs with a viable and scalable business idea. To avoid competing heads on with private actors the interest rates are higher than those from a bank loan.

Almi Invest is the venture capital fund of Almi. It consists of six regional funds and holds, in total SEK 1 billion. Private investors always back the investments made by Almi Invest. Almi Invest does not have any operations in Malmö/Lund according to Almi's web page.

---

[93] VINNOVA, About, http://www.vinnova.se/en/About-VINNOVA/, 2013-02-26
[94] MHBC, About, http://mhbc.se/about_mhbc/, 2013-02-28
[95] Almi, About, http://www.almi.se/om-almi/, 2013-02-28

The advisory services are focused towards a few different areas, Innovation, Entrepreneurship, Mentoring and Other Advisory Services.

6.2.2.6 Innovationsbron

Innovationsbron is owned by the Swedish government and Industrifonden. It functions as an organization completing the market in early stage and seed investments. Their mission is to identify, develop and invest in early stage companies. Since 1994 Innovationsbron has invested in over 300 companies, which makes them the most active seed stage investor in Sweden[96]. Innovationsbron also funds Swedish incubators through the program BIG Sweden, where incubators get result based funding if they provide entrepreneurs with skillful and competent business coaches.

In Skåne Innovationsbron in collaboration with the European Fund for Regional Development has been running the project SEF I. The project aims at investing in 15-20 knowledge intense companies between 2009 and 2014. The project has been evaluated showing positive results with twelve investments being made with approximately SEK 14 million of public and SEK 44 million of private capital[97]. Three of the twelve companies have been sold to larger corporations, among them Malmö-based Polar Rose sold to Apple.

6.2.2.7 Industrifonden

Industrifonden was founded as a foundation by the Swedish government in 1979. Since then it has grown and today it manages SEK 3.6 billion and holds active investments in 90 companies. The foundation is totally self-financed and does not get any capital from the state. Industrifonden has its headquarters in Stockholm as well as local offices of which one is located in Malmö.

The investment focus is small and medium Swedish enterprises with international growth potential. Beyond capital Industrifonden provides network and competence to the portfolio companies. The investment horizon is time limited to a span between five to ten years and the investments are often being made in collaboration with other investors[98].

---

[96] Innovationsbron, About, http://innovationsbron.se/om/, 2012-02-28
[97] Innovationsbron, About the Projects, http://innovationsbron.se/om/projekt/, 2013-02-28
[98] Industrifonden, About, http://www.industrifonden.se/om-industrifonden, 2013-03-13

The most successful investment made by the fund has been in Qliktech, a business intelligence software company founded in Lund. When the company went public on the Nasdaq stock exchange in New York Industrifonden realized a return of 40 times the invested capital[99].

6.2.3 Science Parks

There are four science parks in Malmö/Lund today, Ideon, Minc, Medeon and Media Evolution City. Medeon is focused on life science, hence not explained more in detail in this thesis.

6.2.3.1 Ideon

Ideon is an independent company owned by the municipality of Lund, Lund University, and two real estate companies, Wihlborgs and Ikano Kontor. It is Sweden's oldest science park, founded in 1982, and also one of the most famous science parks in Sweden. According to their web page there are now 260 active companies in the science park spanning several blocks and buildings[100]. Each of the blocks hosts different knowledge and research intense companies within life science, ICT and food science. To be able to get an office or laboratory for your company you have to fulfill the following requirements[101]:

- The company must be connected to Lund University or its faculties.
- The company's operations must be concentrated on high technology
- The company's operations must focus on research and development
- The company must be growth oriented

There are several projects running at Ideon. A recent example is Ideon Open that is a coordinator of open innovation processes between universities and established companies in the region, and Ideon Gateway, the just finished skyscraper hosting a hotel, restaurants and a lot of offices for companies in varying sizes. Ideon also hosts an incubator called Ideon Innovation, described more in the section Technology Incubators.

[99] Industrifonden, History, http://www.industrifonden.se/om-industrifonden/historia, 2013-03-13
[100] Ideon, About, http://www.ideon.se/en/about-ideon/, 2013-02-28
[101] Ideon, Becoming an Ideon Company, http://www.ideon.se/en/about-ideon/becoming-an-ideon-company/, 2013-02-28

6.2.3.2 Minc

Minc is a science park located in the center of Malmö. The science park was opened in 2003 and now hosts Minc/Incubator, Minc/Workspace; an office hotel, and Minc/Meetings; with conference rooms and meeting rooms intended as a meeting place for investors, startups and advisors[102]. Minc is working with companies from many different industries; amongst the more famous Minc companies are Polar Rose, acquired by Apple[103]. The latest acquisition of a Minc company took place in February 2013 when an unknown American company bought Algotrim[104].

6.2.3.3 Media Evolution City

Media Evolution City, MEC, was opened in 2012[105] and is the latest science park initiative in Malmö. It is situated in the central parts of Malmö and hosts a variety of office spaces as well as meeting and conference rooms. MEC stems from the idea of creating a physical meeting place for companies within the media industry in Southern Sweden. It is supposed to be a meeting point for academia and industry, small and large firms as well as for individuals in the media industry. The organizations behind the science park are Media Evolution, a member network for companies in the media industry, The City of Malmö, Region Skåne and the European Regional Development Fund. Wihlborgs is the real estate company that owns the premises.

6.2.4 Universities

There are two universities in the Malmö/Lund region, Lund University and the younger Malmö University. The population in Skåne, the region in which Malmö/Lund is situated, has a tertiary education rate of 32 %, a number well above the OECD average[106].

6.2.4.1 Lund University[107]

Lund University is one of the oldest universities in Sweden dating as far back as to 1666. The university provides education in many different fields:

---

[102] Minc, Offer, http://minc.se/offer.aspx, 2013-02-28
[103] Mike Butcher, *UPDATED: Apple buys Polar Rose for a rumoured $29 million*, TechCrunch, 2010-09-20, http://techcrunch.com/2010/09/20/apple-buys-polar-rose-for-a-rumoured-22-million/, 2012-02-28
[104] Stefan Bohlin, *Hett skånskt it-bolag uppköpt i hemlighet,* it24, 2013-02-26 http://www.idg.se/2.1085/1.494408/hett-skanskt-it-bolag-uppkopt-i-hemlighet?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+idg%2FETkj+%28IDG.se%3A+IDG.se+-+100+senaste%29, 2013-02-28
[105] Lotta Satz, *Fullt hus innan invigningen,* Sydsvenskan, 2012-06-08, http://www.sydsvenskan.se/ekonomi/fullt-hus-innan-invigningen/, 2013-03-01
[106] OECD, OECD Territorial Reviews: Skåne, Sweden 2012, OECD Publishing, 2012, p.77
[107] Lund University, About, http://www.lunduniversity.lu.se/about-lund-university, 2013-03-01

- Engineering
- Science
- Law
- Social sciences
- Economics and management
- Medicine
- Humanities
- Theology
- Fine art, music and drama

Lund Institute of Technology is the school of engineering at the university. The university attracts a lot of students and approximately 47 000 students study here.

6.2.4.2 Malmö University

Malmö University was founded in 1998 and it has been playing an important role in the transformation from an industrial city towards a knowledge intense city. There are four faculties at the university and one school.

- Faculty of Culture and Society
- Faculty of Health and Society
- Faculty of Odontology
- Faculty of Education and Society
- School of Technology

The university has around 25 000 students, many of them with international background.

6.2.5 Technology Transfer Offices

6.2.5.1 LUIS

LUIS stands for Lund University Innovation System and is the Technology Transfer Office at Lund University. The company took its present form in 2009 when the two companies LU Innovation, the public body, and LUAB, the holding company, merged into one. During the last 15 years LUIS has been involved in the creation of 60 new

companies[108]. Information around the success rate of these companies is not described more in detail except for three success cases on LUIS's web page.

The holding company, Lund University Innovation AB, is fully owned by the Swedish government, but managed by Lund University. The holding company makes it possible for the university to form new research-based companies and also to form licensing agreements of research results to established firms. Besides from holding new research based firms and advising researchers, the holding company also presents the opportunity for seed and early stage funding in new companies.

Today LUIS holds 40 companies within its portfolio[109].

6.2.6 Firms

The firms in Skåne County in which Malmö and Lund is situated have been going through structural changes during later years. There has been a clear shift from employees working within farming and production towards the private service sector[110].

The firm composition in Skåne can be seen in the diagram below, Figure 9. As seen the main employers in Skåne is the small companies, companies with fewer than 10 employees account for 86.5 % in employment.

[108] LUIS, About, http://luis.lu.se/en/om_oss/verksamheten, 2013-03-11
[109] LUIS, Portfolio Companies, http://luis.lu.se/en/portfoljbolag, 2013-03-11
[110] Birgitte Stenstruup et al., *Tendens Öresund 2012*, Tendens Öresund, 2012, p. 16

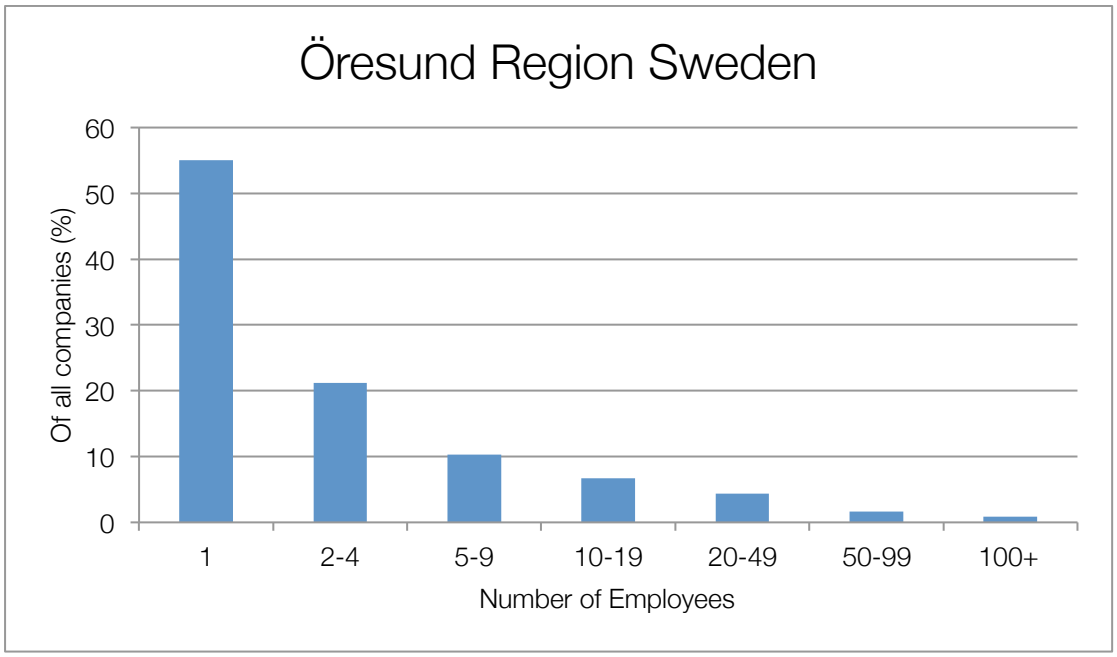


Figure 9: Companies distributed after number of employees in the Swedish parts of the Öresund Region, corresponding to Skåne. Source: Tendens Öresund 2012, p. 23.

Considering Malmö the situation is similar to that of the larger region of Skåne. The firm structure in the city has gone from a few big companies, mainly industrial, to many smaller companies. The firm structure in Malmö is shown in Figure 10 below.

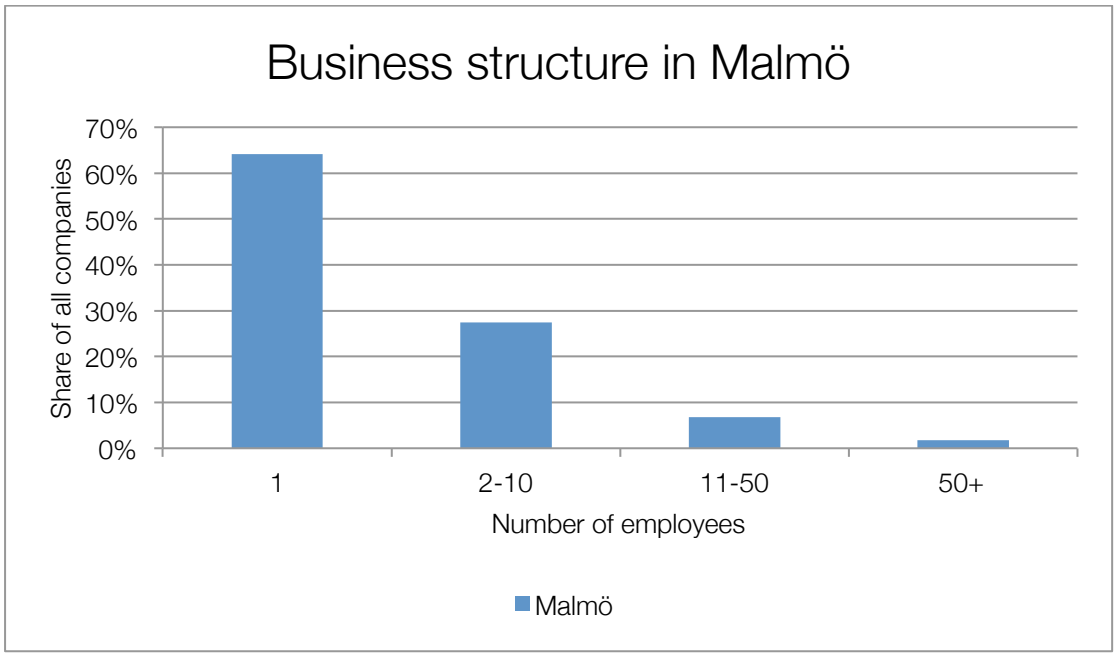


Figure 10: Business structure in Malmö. Malmöläget, Stadskontoret Malmö Stad, 2012, p. 24

With Swedish measures Malmö is an entrepreneurial city. In 2011 eight new businesses were started every day. The highest growth rates, measured in companies started, were

found in following industries, hospitality, media and telecom, retail, and construction[111]. In Figure 11 this is shown in comparison with the two biggest cities in Sweden as well as a Swedish average.

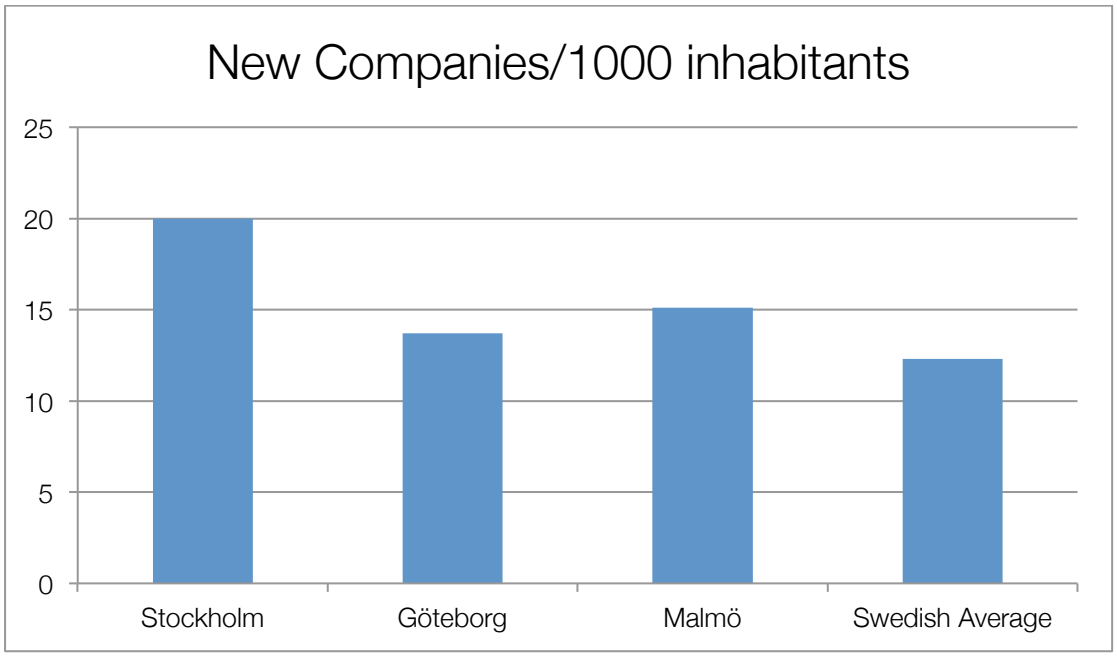


Figure 11: New companies per 1000 inhabitants. Malmöläget, Stadskontoret Malmö Stad, 2012, p. 16

The growth rates in economic terms have also shown an increase. The turnover of Malmö companies during the latest ten years has been growing with 51 %[112].

Unfortunately as extensive information as around Malmö could not be found in the case of Lund. The largest numbers of employees can be found in health and social services, business services, education, producing industry and retail[113]. An assumption will be that the business structure in Lund is similar to the one in Malmö and Skåne as a whole with most employees working in companies with fewer than ten employees.

6.2.7 Venture Capital Organizations

According to Swedish Venture Capital Association, SVCA's investor database, there is only one venture capital investor in Skåne, namely TeknoSeed that is a company owned and managed by the public sector[114]. TeknoSeed Portfolio Management AB holds two funds, TeknoSeed I and TeknoSeed II. TeknoSeed I has its only investor in

[111] Malmö Stad, *Malmöläget*, Stadskontoret Malmö Stad, 2012, p. 15
[112] Malmö Stad, *Malmöläget*, Stadskontoret Malmö Stad, 2012, p. 16
[113] Svenskt Näringsliv, *Företagens betydelse för Lund*, Svenskt Näringsliv, 2012, p. 42.
[114] SVCA, Members in Malmö, http://www.svca.se/MemberSearch?type=Active, 2013-03-12

Innovationsbron and TeknoSeed II has private investors as well as a public one in Innovationsbron. Amongst others the private investors include the local bank Sparbanken Öresund and the insurance company Länsförsäkringar. TeknoSeed invests in companies and takes an active role in developing the company and connecting it with new investors further on[115].

Beyond Teknoseed there is also Sydsvensk Entreprenörfond, a publicly financed venture capital fund located in Lund. The fund has a portfolio of 130 million SEK[116]. It is not focused on any particular industry. The fund is strictly commercially run and today holds 13 companies in its investment portfolio of which one is an ICT company.

The absolute majority of all venture capital firms in Sweden have their offices in Stockholm, for companies in Malmö and Lund however, there is also the possibility to raise venture capital investments from Danish VC-firms situated in Copenhagen or from other international VC-firms.

Skåne has a few business angels; many of them connected to the not-for-profit organization Connect Skåne with their headquarters in Lund. It is stated in their annual report from 2011 that they had 153 active business angels[117], unfortunately there is no data on the amount of capital invested by these angels.

6.2.8 Technology Incubators

6.2.8.1 Ideon Innovation

Ideon Innovation is an incubator situated in Ideon Science Park in Lund. The incubator is a hybrid organization owned by many different stakeholders, Lund University, the municipality of Lund, Teknopol AB, and Ideon Science Park[118]. The incubator offers entrepreneurs business development through coaching, affordable office spaces and financing advice. The incubator program lasts for two years, but a company can choose to end it whenever suitable.

---

[115] Teknoseed, About the company, http://www.teknoseed.se/default.asp?pId=2, 2013-03-13
[116] Interview with Lars Persson, CEO Sydsvensk Entreprenörfond, 2013-03-25
[117] Connect Skåne, *Vår verksamhet 2011*, Connect Skåne, 2011, p. 12
[118]Skåne Regional Council, Ideon Innovation, http://www.skane.se/sv/Skanes-utveckling/Ansvarsomraden/Naringsliv__investeringar/Samarbeten/Foretagsinkubatorer/Ideon-Innovation/, 2013-03-13

The incubator today hosts 22 companies within different industries, 13 of them within the ICT industry. Ideon Innovation also has a pre-incubator where companies during six months work to develop their idea to qualify for the incubator. In the pre-incubator six companies are active of which one is an ICT company[119].

6.2.8.2 Minc/Incubator

Minc is situated in the central parts of Malmö, close to Malmö University. The incubator was founded by the municipality of Malmö in 2003 and is still owned by them. The incubator mainly works with companies within ICT, design, and digital media and offers them business development assistance through coaching, connects them with capital, and provides the companies with affordable office space[120].

The incubator has a capacity of 25 companies and today there are 20 active companies participating in the two years long incubator program. Of these 20 companies 11 are ICT and digital media companies[121].

6.2.8.3 VentureLab

VentureLab is Lund University's student incubator. The incubator was founded in 2001 and provides student entrepreneurs with free office space and business advice during a one-year period. The incubator is open for companies within all different industries, and every year new companies apply and get chosen to be an incubator company by a jury consisting of people from academia and business[122].

According to VentureLab's web page there are 12 companies participating in the incubator process today of which nine are related to ICT and digital media[123].

---

[119] Ideon Innovation, About, http://www.ideoninnovation.se/sv/company/15/inkubator, 2013-03-13
[120] Minc, About the Incubator, http://www.minc.se/about_incubator.aspx, 2013-03-13
[121] Minc, Incubator, http://www.minc.se/incubator.aspx, 2013-03-13
[122] VentureLab, About, http://www.venturelab.lu.se/page.php?id=1, 2013-03-13
[123] VentureLab, Incubator Companies, http://www.venturelab.lu.se/page.php?id=11, 2013-03-13

6.3 Challenges and Opportunities

The following section describes some of the main challenges in the emergence of an innovative cluster in Southern Sweden. The broader defined region of Skåne faces huge innovation opportunities according to the report *OECD Territorial Reviews: Skåne 2012*. The main challenges and opportunities in the region are visualized by Region Skåne, the regional "parliament" in Skåne, in a model like the one below[124]. The model builds upon the conclusions in the OECD report, elaborated upon in the sections below.

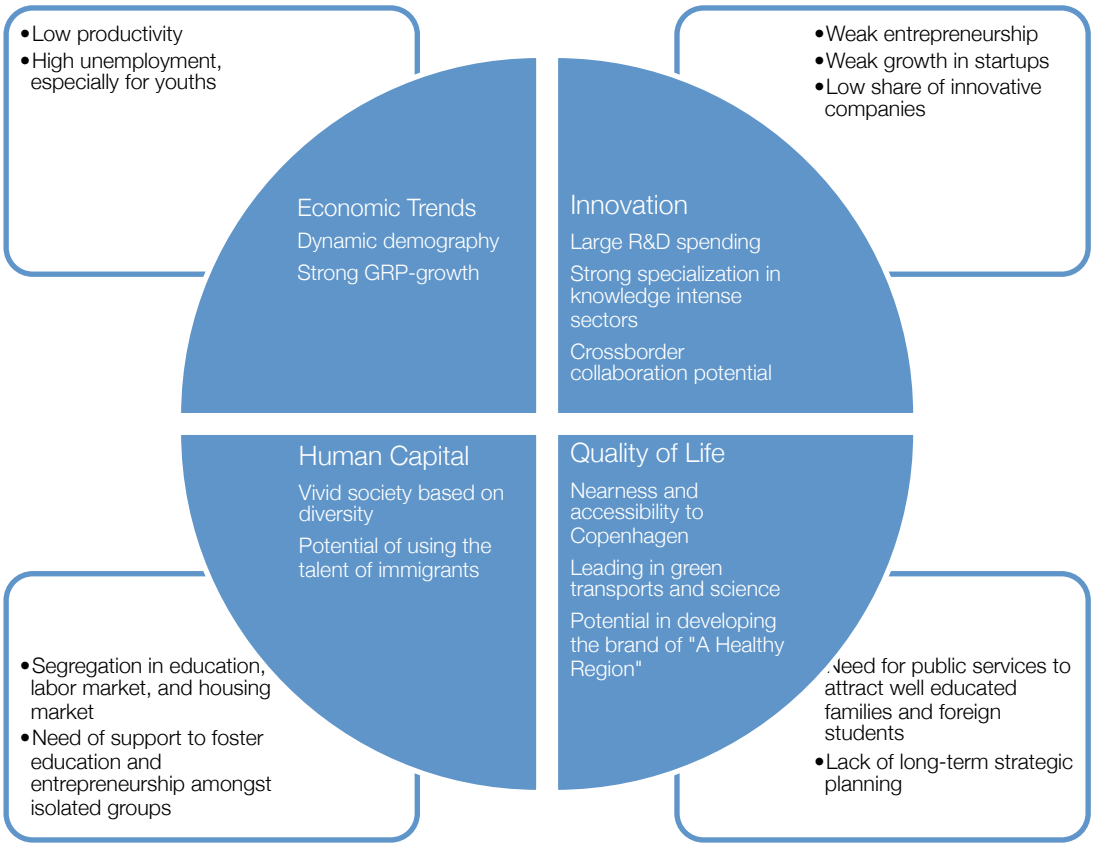


Figure 12: Challenges and opportunities in Skåne.

6.3.1 Economic Trends

Since the financial downturn in 2008 Skåne has faced diminishing growth rates. Also the labor market has been faced with weak numbers. Skåne is the county in Sweden that has the highest unemployment rates, going as far up as to 26 % in 2010[125]. Further on, there have been a lot of people moving into Malmö and Lund, causing the labor market to lag

[124] OECD, *OECD Territorial Reviews: Skåne, Sweden 2012*, OECD Publishing, 2012, p.22
[125] Ibid, p.55.

behind since many of these newcomers have had difficulties in finding a proper employment.

On the other hand, the high technology sector in the region is growing at a steady pace. However, the job creation in the sector does not follow. There are two solutions to this problem according to the report; to broaden and enhance the entrepreneurial base and to attract more well-educated people to the region.

6.3.2 Innovation

The strengths and weaknesses in the regional innovation system in Skåne are shown in Figure 13.

Strengths	Weaknesses
Strong academic research	Lack of government research institutes
High R&D investments, large pool of researchers	Small number of R&D-intensive firms
Good general qualification of population/lifelong learning	Too large a share of low-educated people
Strong specialisation in knowledge-intensive services	Innovation in the services sector under-exploited
Matching specialisation in public research and industry, in medical science, natural and environmental technology, ICT	Lack of entrepreneurs and entrepreneurship
Presence of leading large companies	New firms remain small
Cross-border openness: centrality in periphery	Short value chains, little production in the region
	Intra-regional imbalances in innovation
	Limited inflow of foreign students and researchers

Figure 13: The strengths and weaknesses of the regional innovation system in Skåne according to OECD. Source: OECD, OECD Territorial Reviews: Skåne, Sweden 2012, OECD Publishing, 2012. P. 99.

Today there are many initiatives and organizations active in Skåne with the goal to foster and enhance innovation in the region. Though this might be good there is a problem in the evaluation of these initiatives. With a lack of evaluation there is no evidence of what is actually creating jobs and economic growth, and there is no way to sort out the successful projects from the less successful.

There is also a tendency towards the public sector being the main driver when it comes to innovation issues. According to OECD the private sector needs to step up and take the lead in this field. This can also lead to higher private investments in innovative companies, a must to create a vivid entrepreneurial economy in the region.

The Öresund Region has a strong position when it comes to R&D spending. 38 % of all public investments in Denmark and Sweden combined are invested in the region[126]. This innovation paradox can be explained with mainly three factors according to OECD, 2012. First, the R&D findings in Skåne are commercialized on other markets and the profits are realized in other countries. Second, there is a weak entrepreneurial activity in Skåne and the companies started tend to face low growth rates. Third, and lastly, the SME's in the region faces innovation barriers and do not innovate as much as needed[127]. On a regional basis, there are mainly two ways to solve this paradox. The first way is to invest more in the research and technology base. This needs to be accompanied by an enlargement of the base of innovative firms that constitutes the second, more demand driven way of solving the innovation paradox[128].

6.3.3 Human Capital

In the aspect of human capital, the region needs to address a number of challenges. In the region there are a demographic dynamism, unfortunately this dynamism has not affected the economic realm. To be able to reap the fruits of the dynamic demographics initiatives needs to be taken to enhance integration of groups isolated from the labor market, such as immigrants, women and youths. This has to be done through lowering the integration obstacles and provide better acceptance and access to the labor market.

Concerning the education system there are a mismatch between demand from the market and supply from the educational organizations. In order to stay competitive that matching problem has to be solved to better supply the companies in the region and the labor market with the competences sought for. Another challenge concerning the education system is to strengthen the overall quality of the education system. There is also a need to enhance the human capital base through attracting well-educated families from all over the world as well as foreign students.

6.3.4 Quality of Life

There are a lot of opportunities in enhancing the quality of life in the region. As mentioned before, the education system needs to be improved year after year to attract creative people to the region. There is also a need to raise the overall quality of life in the

[126] OECD, *OECD Territorial Reviews: Skåne, Sweden 2012*, OECD Publishing, 2012, p.103
[127] Ibid, p. 110
[128] Ibid, p. 112

region to being able to attract highly educated families. What can be done, according to the report is to found international schools, create a more qualitative housing market, and to create a better supply of cultural activities in the region.

There is also a need for more long-term strategic planning due to the matter of a heightened quality of life.

7. The Innovation Ecosystem Model in Practice

In this chapter the analysis model, The Innovation Ecosystem Model, *has been applied on the Israeli ICT-cluster. The empirics from Malmö/Lund have then been "projected" on the empirics from Silicon Wadi in order to provide a base for discussion around the main differences and similarities between the two clusters. The discussion, the last part of this chapter, will provide useful insights in the next chapter, conclusions.*

This chapter aims at achieving the sub purpose concerning the benchmarking of the two clusters.

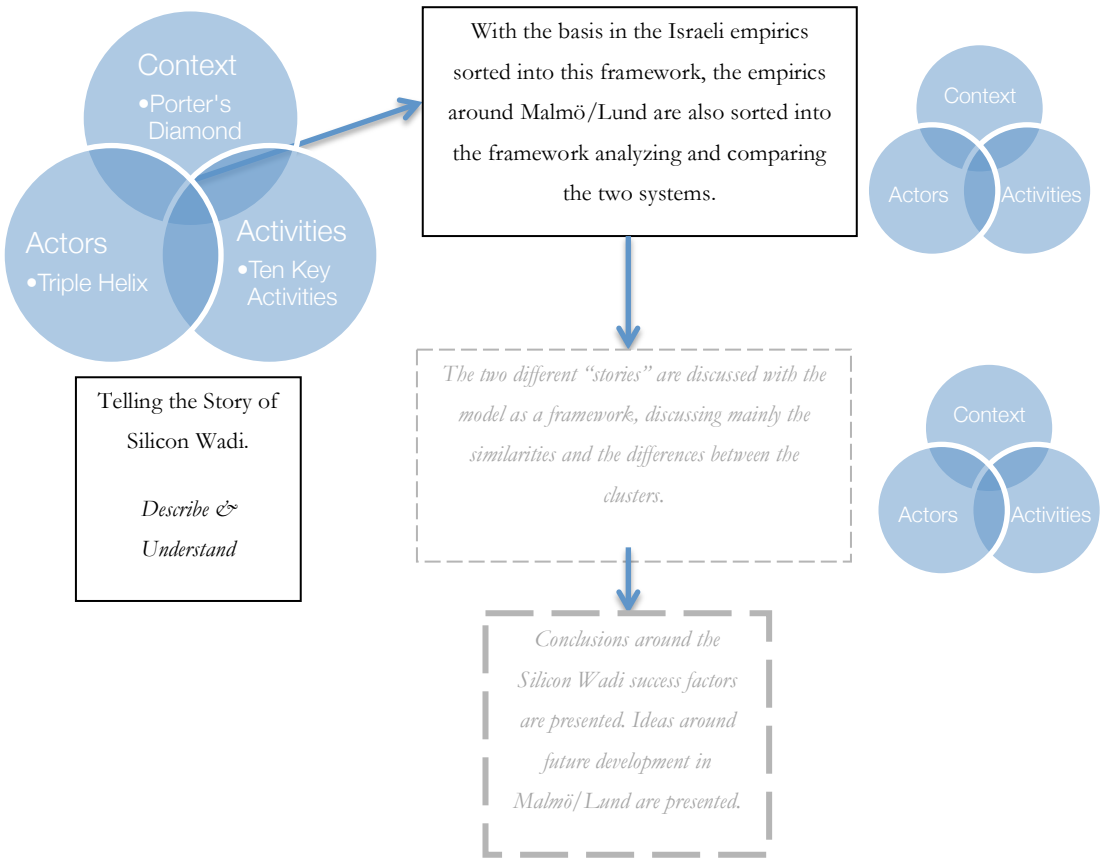


Figure 14: How the Innovation Ecosystem Model has been applied in this chapter

7.1 Context

7.1.1 Factor Conditions

7.1.1.1 Silicon Wadi

The main comparative advantage within the factor conditions in Silicon Wadi is human capital in general. The labor force is generally well educated with an attainment to tertiary education of 44,9 % in 2009, according to OECD[129].

The knowledge base is rather specialized and there are three stocks of R&D, military R&D, university R&D, and the stocks of R&D knowledge from Russian immigrants arriving in the early 1990's.[130] As Silicon Wadi develops an increasing stock of R&D from multinationals and private companies augment the knowledge base within R&D in Israel.

Furthermore the mandatory military service has a significant impact in teaching young people about engineering, leadership and management. This leads young Israelis to develop a special sense of responsibility[131].

Porter, 1990, describes that factor conditions need to be specialized to create a sustained competitive advantage. The specific needs of the military have done this, creating a cutting edge knowledge base within e.g. electro-optics.

Other factor conditions are reliable infrastructure, tax-cuts for establishing R&D organizations and stable government with low corruption, low crime and property risks[132]. There is also a well-established VC-industry in Israel.

The main competitive disadvantage in Israel is the lack of physical resources. Kaplan, 1998, said in his article *Israel: A high-tech Haven*, that Israel has "sunshine as its only plentiful resource"[133]. This further emphasizes the need for high quality human capital.

---

[129] OECD Country Statistical Profile: Israel, http://www.oecd-ilibrary.org/economics/country-statistical-profile-israel_20752288-table-isr, 2012-12-18
[130] Catherine de Fontenay et al., *Israel´s Silicon Wadi, The Forces Behind Cluster Formation,* Building High-Tech Clusters, Silicon Valley and Beyond, Cambridge, Cambridge University Press 2004, p. 48
[131] Ibid, p. 51
[132] Ibid, p. 45
[133] Gadi Kaplan, *Israel: A High-Tech Haven*, IEEE Spectrum 35, 1998, pp. 22-32

7.1.1.2 Malmö/Lund

Being a part of a western world country, the region of Malmö/Lund is also moving towards an increasingly human capital intense industry structure. The shift from manufacturing to private service sectors, seen especially in Malmö during the last 30 years has manifested this trend. Hence, the situation in Malmö/Lund is similar to the one in Israel, with human capital being one of the most important factor conditions today. Concerning education, statistics from OECD show a level of attainment on tertiary level of 34.2 % in 2010[134]. This is a number lower than in Israel, but still quite high on an international basis.

The R&D-stocks in Malmö/Lund have been shifting during later years. When giant corporations such as Sony Mobile established in the region are struggling, less focus are put on industry R&D. Hence, the main R&D stock is academic, not creating the same diversity or dynamism as seen in Israel where R&D stocks from the military, the industry, from immigrants, and academia are combined, creating truly novel solutions.

The specialized factor condition provided by the mandatory military service in Israel is nowhere to be seen in Malmö/Lund. When moving towards a human capital intense industry, something that fosters both responsibility and maturity is a true competitive advantage. To get back to mandatory military service in Sweden would be utopian, but the need of an institution teaching applied leadership in complex situations as well as advanced technology skills, is something needed to look further into.

Further on the multitude of nationalities and cultures in both Malmö and Lund is something that can create a significant sustainable competitive advantage in the region. Up until today, people with foreign backgrounds face much higher unemployment rates[135]. To realize the real benefits of the multicultural environment in Malmö/Lund, measures need to be taken to further foster integration in the region.

---

[134] OECD, Country Statistical Profile: Sweden 2013, http://www.oecd-ilibrary.org/economics/country-statistical-profile-sweden_20752288-table-swe, 2013-02-22

[135] OECD, *OECD Territorial Reviews: Skåne, Sweden 2012*, OECD Publishing, 2012, p.86

7.1.2 Demand Conditions

7.1.2.1 Silicon/Wadi

The problem facing Israel, as well as many other small countries, is the insufficient local demand. BIRD (Binational Industrial Research and Development) was founded in 1977 by the Israeli and US government in order to foster deeper collaboration between firms in the two countries[136]. This was also an attempt to extend the market for Israeli companies and innovators. BIRD contributed 50 % of research costs in a joint research project where an established large US firm collaborated with an Israeli company. Typically the US firm stood for marketing and distribution under their brand name and the Israeli firm stood for manufacturing.

The internet has been an enabler and a "market-enlarger" for Israeli software and telecom companies. The nature of these technologies is often immaterial and they are easily distributed internationally over the internet. Furthermore Senor and Singer argue in their book *Start-up Nation,* 2009, that the country, surrounded by enemy states and experiencing boycotts, adopted ICT and internet technologies rapidly. The adoption, they mean was out of necessity, in order to gain independence from their geographical situation[137].

Finally, with a small domestic market, the military again played an important role in demanding advanced research and functioning as a facilitator for inventions coming into use in the defense sector, many of them leading to commercial products. The military research leads to a lot of low hanging fruits, in terms of technologies that generally are not protected by IP-laws. These technologies can adapt into civilian use and into new technology ventures[138].

7.1.2.2 Malmö/Lund

The region of Malmö/Lund is just as Silicon Wadi a small region. The same goes on the national level, the Swedish market is just like its Israeli equivalent, a small market, about

---

[136] Catherine de Fontenay et al., *Israel´s Silicon Wadi, The Forces Behind Cluster Formation,* Building High-Tech Clusters, Silicon Valley and Beyond, Cambridge, Cambridge University Press 2004, p. 56
[137] Dan Senor et al., *Start-up Nation, The Story of Israel´s Economic Miracle,* New York, Hachette Book Group, 2009, p. 61
[138] Catherine de Fontenay et al., *Israel´s Silicon Wadi, The Forces Behind Cluster Formation,* Building High-Tech Clusters, Silicon Valley and Beyond, Cambridge, Cambridge University Press 2004, p. 49

the same size population-wise. Just like in Israel internet has played an important role in enlarging the market and demand for Swedish ICT companies, many of them aiming at a global market from day one.

7.1.3 Firm Strategy, Structure and Rivalry

7.1.3.1 Silicon Wadi

To describe the structure of the Israeli firm one need to go back to the countries roots as well as to understand the magnitude of which the compulsory military service affects the business sector in Israel.

The country, once socialistic, has created a heritage of collectivism. This heritage was manifested in the cooperatively owned farmlands, the so-called Kibbutzim's. The Kibbutz was also a place for innovation and one of the world's leading drip irrigation companies, Netafim, was created in one of these Kibbutzim's[139]. The collectivist values has up to date been paired with individualistic ones, creating a dynamic rarely seen anywhere else. Furthermore the notion of shared identity and shared purpose of survival has been important in the creation of the communal values[140].

To understand the way companies are run in Israel, it is important to understand how the military is organized. The Israeli Defense Forces (IDF) is a very flat organization where teamwork, criticism, and open feedback are inherent. After every day of operations soldiers are having long debriefs, debating over what went wrong and what went right. There is a value neutral attitude towards performance, what matters is what you learn from doing well or from making mistakes[141]. Further on, military operations are often very complex and uncertain, and young people face a lot of responsibility at a young age. What all this implies is that the military service creates individuals well suited for working in small teams facing a lot of complexity, typically a new technology venture. According to de Fontenay et al. 2004, there are evidence Israelis prefer smaller, flat organizations before larger organizations[142]. There is also a widespread notion of the lack of larger

---

[139] Dan Senor et al., *Start-up Nation, The Story of Israel´s Economic Miracle,* New York, Hachette Book Group, 2009, p. 110
[140] Catherine de Fontenay et al., *Israel´s Silicon Wadi, The Forces Behind Cluster Formation,* Building High-Tech Clusters, Silicon Valley and Beyond, Cambridge, Cambridge University Press 2004, p. 52
[141] Dan Senor et al., *Start-up Nation, The Story of Israel´s Economic Miracle,* New York, Hachette Book Group, 2009, p. 30
[142] Catherine de Fontenay et al., *Israel´s Silicon Wadi, The Forces Behind Cluster Formation,* Building High-Tech Clusters, Silicon Valley and Beyond, Cambridge, Cambridge University Press 2004, p. 52

companies in Israel, described by Senor et al. 2009 with the question "Where is our Nokia?"[143].

7.1.3.2 Malmö/Lund

As with Silicon Wadi one also needs to understand the cultural aspects inherited through generations to understand the firm structure in Malmö/Lund. In Sweden there has long been reliance on the public sector and on large corporations. This might have created a cultural bias where new company creation and more importantly their growth rates are weak[144]. To work in small teams and take an entrepreneurial career path is not that common in Malmö/Lund.

The industry structure in Skåne, the region in which Malmö/Lund is situated, is mainly made up of small companies. Companies with fewer than 50 employees constitute around 95 % of all companies in Skåne, similar to the structure in Israel. One can also see a tendency towards even more small companies, especially in Malmö where the business sector earlier was made up of a few, large manufacturing firms[145].

7.1.4 Related and Supporting Industries

7.1.4.1 Silicon Wadi

Before the Emergence Phase, described by Harel and Avnimelech (2012) there was a lack of related and supported industries to the ICT sector. Up to then the focus had been on creating an infrastructure for knowledge creation and international cooperation. The growth of the cluster started in the early 90's by primarily the emergence of the VC industry. If the VC industry was the spark that lit the fire in Israel, there has since then been a development of advanced services within several categories such as personnel services, executive headhunting, specialized accounting, legal and tax counsel, strategy consulting and research[146].

Further on, the incubators and the TTO's in Israel can be seen as important actors in the support system around new ICT companies.

---

[143] Dan Senor et al., *Start-up Nation, The Story of Israel´s Economic Miracle,* New York, Hachette Book Group, 2009, p. 230
[144] OECD, *OECD Territorial Reviews: Skåne, Sweden 2012*, OECD Publishing, 2012, p.111
[145] Malmö Stad, *Malmöläget*, Stadskontoret Malmö Stad, 2012, p. 23
[146] Catherine de Fontenay et al., *Israel´s Silicon Wadi, The Forces Behind Cluster Formation,* Building High-Tech Clusters, Silicon Valley and Beyond, Cambridge, Cambridge University Press 2004, p. 68

7.1.4.2 Malmö/Lund

In the Malmö/Lund region the public support system is in place and well developed. There is an array of organizations in place to support ICT companies in their daily business life. For example, on the small geographical area of Malmö/Lund there are several incubators and science parks as well as world-class education institutions supporting growing companies with the latest knowledge.

However, the public initiatives are not themselves enough. Some might even say that they are contra productive, creating a safe environment for startup companies isolated from real world challenges. The most pressing need in Malmö/Lund is the need for more private investors. The region needs commercial venture capital firms being able to put their money in local companies ready to grow.

7.2 Actors

In the Silicon Wadi case, as with so many other cases, an extended version of the Triple Helix model is suitable for visualizing the most important organizations in the cluster. The hybrid organizations in Israel is for example incubators, where private investors and governmental funds both co-finance companies. The TTO's are another example of a hybrid organization with its combination of academic R&D and its form as an autonomous company. The OCS is a facilitator in the triple helix in Israel with their different programs. The Magnet program is such an example with the government funding a collaborative research effort between industry and academia. Another example is Yozma. In this program the government initiated the program through investing $100 million but with a clear statement that the funds where to be privatized after five years.

However, the hybrid organizations and the trilateral networks created in Israel are created deliberately with a certain focus. Once again, Magnet or Yozma states a clear example of this. Magnet was created with the focus to promote industry-academia collaboration and Yozma was initiated aiming at creating a VC industry in the country.

In Malmö/Lund the organizations are as well to a high degree not just industry based or state owned, but rather a combination of the three main actors in the Triple Helix model, academia, industry and state. What can be said about the organizations that act as supporters in the cluster, such as incubators, science parks and financial institutions in Malmö/Lund is that they often seem to have rather complex ownership structures.

The firms acting in the ICT-cluster are, as in Israel mainly privately owned. The extent to which the state is involved in so many aspects of the innovation system in Malmö/Lund can be questioned as well as the purpose of all the different support organizations in the innovation system. When talking to people active in startups or in other ways engaged in the ICT cluster, the picture painted by Sydsvenskan in the article previously mentioned has been validated. There seems to be a lot of activities carried out by many different organizations, with no clear strategy or purpose.

A lot can be learnt from Israel in this aspect. In Israel the state-initiated companies and policies are carefully managed and they have a clear purpose in the light of which they are managed and measured. The OCS can also act as a role model in making the cluster in Sweden overall leaner and less bureaucratic. In Sweden there are national, regional and local initiatives around the fostering of innovation created for the same purpose but on different political levels. The initiatives are colliding and overlapping and there is a lot of bureaucracy attached to such a system. Sweden can definitely use the Israeli example as a role model since the two nations are of similar size. A more "Israeli" way of creating a cluster would for example be to have one centralized state-managed innovation office enacting policies and managing fewer but more focused innovation programs. To privatize funds owned by the state and forcing incubators to work in a more commercial way are other ways of creating a more dynamic innovation climate in Sweden.

7.3 Activities

7.3.1 Knowledge Inputs to the Innovation Process

Provision of Research and Development (R&D), creating new knowledge, primarily in engineering, medicine and the natural sciences.

The Israeli universities are the primary supplier of R&D when it comes to engineering, medicine, and the natural sciences. The universities are well renowned on a global basis, and of most importance seems to be Technion, Israel Institute of Technology in Haifa. The university was already founded in 1912 and today it covers all the areas of engineering, medicine and natural sciences.

The research stock in Israel is, as described earlier, based on three sources of knowledge and R&D, namely military R&D, university R&D and R&D knowledge coming from

immigrants, mainly Russian[147]. Of growing importance is the R&D coming from large multinational R&D departments such as IBM, Microsoft, Intel and Google, all of them based in Israel.

In Malmö/Lund the main providers of R&D are Lund University and Malmö University. Lund University is one of the strongest research facilities in Scandinavia[148]. While Malmö/Lund does not possess the R&D stock from the military, the world's leading research center within materials science will be completed in Lund in a near future. This will heavily increase the research activity in the region, both the research conducted by the university as well as the research conducted by private companies and researchers from universities abroad. The research center consisting of two different research facilities, ESS and MAX IV, can give Malmö/Lund the competitive advantage that the military R&D function in Israel has given that country. It is also important to initiate activities to integrate foreign-born people in the region and in the labor market. A multicultural labor market will, quite certain, give the region a competitive edge. How this and ESS MAX IV will affect the ICT industry is of course uncertain, however, with a vivid and multicultural research milieu Malmö/Lund might attract researchers from many different fields as well as multinational companies' R&D centers.

Competence building (provision of education and training, creation of human capital, production and reproduction of skills, individual learning) in the labor force to be used in innovation and R&D activities.

Under this specific activity, no suitable empirics have been found to analyze neither in Silicon Wadi nor Malmö/Lund.

7.3.2 Demand Side Factors

Formation of new product markets.

The Israeli government has been proactive in creating new markets; first and foremost market links to other, bigger markets. The LECI law was created in 1959 and it was deliberately biased towards foreign investors to create market links and R&D collaboration between the small Israeli market and markets outside the nation. The

[147] Catherine de Fontenay et al., *Israel´s Silicon Wadi, The Forces Behind Cluster Formation,* Building High-Tech Clusters, Silicon Valley and Beyond, Cambridge, Cambridge University Press 2004, p. 48
[148] Lund University, Strong Research Milieu, http://www.lu.se/forskning/starka-forskningsmiljoer, 2013-03-27

BIRD program described earlier was another initiative to be able to extend the Israeli R&D capabilities to primarily the US market.

The proactivity seen in Israel concerning the extension of the market through different policies has not yet been as prevalent in Malmö/Lund as in Silicon Wadi. The innovation strategy put forth by Skåne Regional Council, however, suggests more initiatives to open up for more internationalization and foreign market access[149].

Articulation of quality requirements emanating from the demand side with regard to new products.

With the demand side in Israel being rather small due to the country's small domestic market the industry is skewed towards highly advanced technological business-to-business ICT solutions. The quality requirements demanding this type of products might stem from the Israeli military forces, and the lack of other organizations demanding high quality requirements. The military has long been requiring advanced technological solutions that work in a rough environment. The problem this has caused, however, is that the Israeli ICT cluster faces a lack of designers and distributors of their products. The work done by these two categories of workers has often been done by the multinationals acquiring the advanced technology companies.

The Swedish market is often said to be a good test bed for ICT companies due to the high requirements from the rather ICT-mature Swedish population. The Swedish ICT companies have as well been leading in the design and distribution of their products and services. A great example is Malmö-based TAT now acquired by Research in Motion, RIM, that was chosen as the user interface designers for Google's Android, the mobile operating system. Formally articulated quality requirements have however not been identified.

7.3.3 Provision of Constituents of SI's

Creating and changing organizations needed for the development of new fields of innovation, e.g. enhancing entrepreneurship to create new firms and intrapreneurship to diversify existing firms, creating new research organizations, policy agencies, etc.

[149] Forsknings- och innovationsrådet, Soundingboard Innovation i Skåne, *En internationell innovationsstrategi för Skåne 2012-2020*, 2011, p. 8.

The most important organization governing the creation and change of organizations in the cluster in Silicon Wadi is OCS. OCS has been the organization behind the incubator program, Yozma and many other policies and program. It is also the leading governmental arm of the creation of new R&D organizations, for example through the Magnet program, as well as the main central organization for creating industry policies.

The incubators are in themselves a very important factor in the emergence of the regional ICT cluster in Israel. They have been providing both funding, mentorship, physical workplaces, and exit opportunities for Israeli entrepreneurs with business ideas deemed scalable and full of potential. Hence, the incubators are somewhat different from the classical notion of an incubator as merely an office space for entrepreneurs.

The TTO's also play an important role in the creation of new firms and to foster entrepreneurship. With their close relationship to universities, they play an important role in the commercialization of university R&D.

In Malmö/Lund there has been a notable eagerness in creating new organizations supporting and fostering entrepreneurship. VINNOVA can be said to be the main central state department for innovation systems in Sweden. They are currently running nine different programs to actively promote innovation within the ICT sector, ranging from open innovation to the future of communication[150].

On a local basis there are the incubators, different advisors such as Teknopol and other publicly financed organizations both advising and investing in new companies. The creation of new firms, and more importantly their ability to grow, is lagging behind in Skåne in general[151], an indication the activities carried out by the organizations active in the support system might need to change.

Networking through markets and other mechanisms, including interactive learning between different organizations (potentially) involved in the innovation processes. This implies integrating new knowledge elements developed in different spheres of the SI and coming from outside with elements already available in the innovating firms.

---

[150] VINNOVA, Services within ICT, http://www.vinnova.se/sv/Var-verksamhet/Tjanster-och-IKT/, 2013-03-27

[151] OECD, *OECD Territorial Reviews: Skåne, Sweden 2012*, OECD Publishing, 2012, p.111

One of the OCS-programs created to better establish collaboration between different organizations in the Israeli cluster is Magnet. Magnet brings together multinationals and universities in research consortia, in order to develop generic technologies. The program has been successful and there are today 31 consortia in Israel.

The TTO's also play a role in this activity. They combine entrepreneurial drive, investor's capital, and university R&D to commercialize the R&D findings at the different universities.

The different policies, programs and laws such as BIRD, LECI and LEIRD has been working well in establishing an international presence in Israel attracting foreign companies through government subsidized R&D projects and bilateral agreements.

The science parks in Malmö/Lund play an integral role in creating an arena for networking between different actors in the cluster. The latest initiative, Media Evolution City is having regular conferences, events and lectures on new media and ICT. Also Ideon in Lund has been acting as a facilitator for cross collaboration between actors in the cluster. As a hybrid organization, it has fostered collaboration between large corporations and academia with its program Ideon Open. Ideon Open is an open innovation platform where students and companies meet, the companies present their challenges and their future visions and the students then work on solving these problems and realizing the future visions through different product prototypes. Mobile Heights Business Center, a network organization, is another initiative working towards creating stronger links between entrepreneurs, academia and large corporations. They are also trying to convince multinationals such as Google to locate a research facility to the region.

The OECD territorial review of Skåne points out that the region is performing very well on technological innovation. There is however a huge problem, the SME's in the region scores very low on innovativeness[152]. In this area, activities are needed to create networks between the SME's, academia and larger firms in the region.

Creating and changing institutions – e.g. IPR laws, tax laws, environment and safety regulations, R&D investment routines etc. – that influence innovating organizations and innovation processes by providing incentives or obstacles to innovation.

[152] OECD, *OECD Territorial Reviews: Skåne, Sweden 2012*, OECD Publishing, 2012, p.97

Also in this category the OCS has played an integral role in the R&D field. Their different programs and policies have been most influential in influencing and incentivizing the innovation processes and organizations.

The mother organization Ministry of Industry, Trade and Labor, MOITAL, is the main governmental ministry to promote growth of the Israeli economy. It also plays a role when it comes to the changing of institutions such as safety regulations, union rights and labor force regulations.

Skåne Regional Council and the local governmental organizations, the City of Malmö and the City of Lund, conduct the work around creating and changing institutions in Malmö/Lund. Skåne Regional Council is the most active part as they have also created an innovation strategy for the whole of Skåne. The strategy will focus on the operational aspects of the innovation system since the legislative power lies within the Swedish government. These operational activities influences the innovation actors, the innovation system as well as the innovation processes. The strategy includes for example a stronger and clearer systemic leadership in the regional innovation cluster, a more efficient innovation support structure and more international cooperation.

As one understands there are a lot of differences between the centralized Israeli model and the Swedish model that is centralized, decentralized and local. In the innovation strategy for Skåne, one can see tendencies moving towards the Israeli direction, with stronger leadership, however, only on the regional level. There are still many challenges trying to coordinate the different innovation systems and clusters throughout Sweden on a national level.

7.3.4 Support Services for Innovating Firms

Incubating activities, e.g. providing access to facilities, administrative support, etc. for new innovative efforts.

The main organizations to support innovating firms are, and have been, the incubators in the Technological Incubator Program. As mentioned before they provide entrepreneurs in newly started businesses with a physical working place, financing, business and technology advice, and also help the companies get in touch with VC's. The TTO's have also played an important role in supporting small firms. With a structure similar to the

incubators the TTO's governed by the universities but run as independent, for-profit firms, have focused on commercializing inventions stemming from university research.

A new breed of support organizations have started to occur in the Israeli cluster as described in the section *Trends in the VC industry*. These are the angel groups such as TechAviv and Startup Factory, located in Tel Aviv and Herzliya. The angel groups work in a similar fashion as the incubators and TTO's but they don't provide office space. They focus on scanning the market for startups, investing in selected companies and then mentoring these companies.

As in Israel the incubators in Malmö/Lund is the main facilitator of incubating activities. There are nonetheless major differences between how the incubators are functioning in the two regions. Both in Malmö/Lund and Israel the incubators provide office space, administrative help and business advice. In addition to this the incubators in Israel invest in the companies they accept in the incubator, functioning as a seed fund. This is not the case in Sweden. The ownership of the incubators is also different, in Israel most of the incubators are privatized, some of them even publicly traded, in Malmö/Lund the incubators are often owned by different public organizations. In order to reap the benefits from having an incubator system there might be a need for more commercial drive and more connection to capital in the incubators in Malmö/Lund.

Financing of innovation processes and other activities that can facilitate commercialization of knowledge and its adoption.

In the early stages, funding for companies can be derived from mainly the incubators and angel investors.

For companies beyond the early stages the well-developed VC industry is the main source of funding. As mentioned before there is an array of domestic VC companies as well as international VC firms both with and without local offices in Silicon Wadi.

If venture capital is abundant in Israel that is not the case in Malmö/Lund where there are no private VC-firms with offices in the region. In the early stages entrepreneurs can turn to one of the many state governed organizations, such as Almi or Innovationsbron, to acquire capital in the form of investments or soft loans. In the region one can also

turn to Connect Skåne to get in touch with business angels ready to invest in the early stages of a company.

For more mature companies there are Industrifonden and Sydsvensk Entreprenörfond, providing expansion capital. Many of the investments being made by the state owned funds build just like Yozma on co-funding.

The most pressing problem in Malmö/Lund might not be the scarce access to capital; it might be the lack of competent capital. The Yozma program in Israel provided the Israeli finance market with capital as well as with competence from major international investment firms. The public investors and the business angels in Malmö/Lund do not to the same extent have this commercial drive or an instinct for growth, something that is needed in order to compete on a global VC market.

Provision of consultancy services of relevance for innovation processes, e.g. technology transfer, commercial information, and legal advice.

Again, the incubators and TTO's play an important role in advising early stage companies. In the wake of the growth of the Israeli tech boom during the 90's there is now also an established base of professional service suppliers in the country.

The companies funded by angel groups get access to consultancy services in patent law, financing, accounting etc. within the angel groups partner networks.

In Malmö/Lund there are an array of professional private service companies within management, finance, tax, advertising and technology. Also the TTO's and the incubators have the role of advising entrepreneurs and researchers on how to commercialize their inventions. Nonetheless, one has not yet seen a convincing number of high growth ICT companies stemming from an incubator milieu or from the TTO at Lund University. Once again the commercial and entrepreneurial drive is sometimes missing in these, mainly state owned, organizations. In order to compete, the incubators and TTO's in Malmö/Lund need to look at best practices from Silicon Wadi.

7.4 Discussion - Differences and Similarities Between the Clusters

This section aims at discussing the main differences and similarities between the two clusters as shown in the model below. This part is elaborating upon one of the sub purposes stated in Chapter 1, Introduction, namely: To benchmark the cluster in Silicon Wadi and the one in Malmö Lund: Which are (or seems to be) the key similarities and differences between Silicon Wadi in Israel and the Malmö/Lund region? This is visualized in Figure 15.

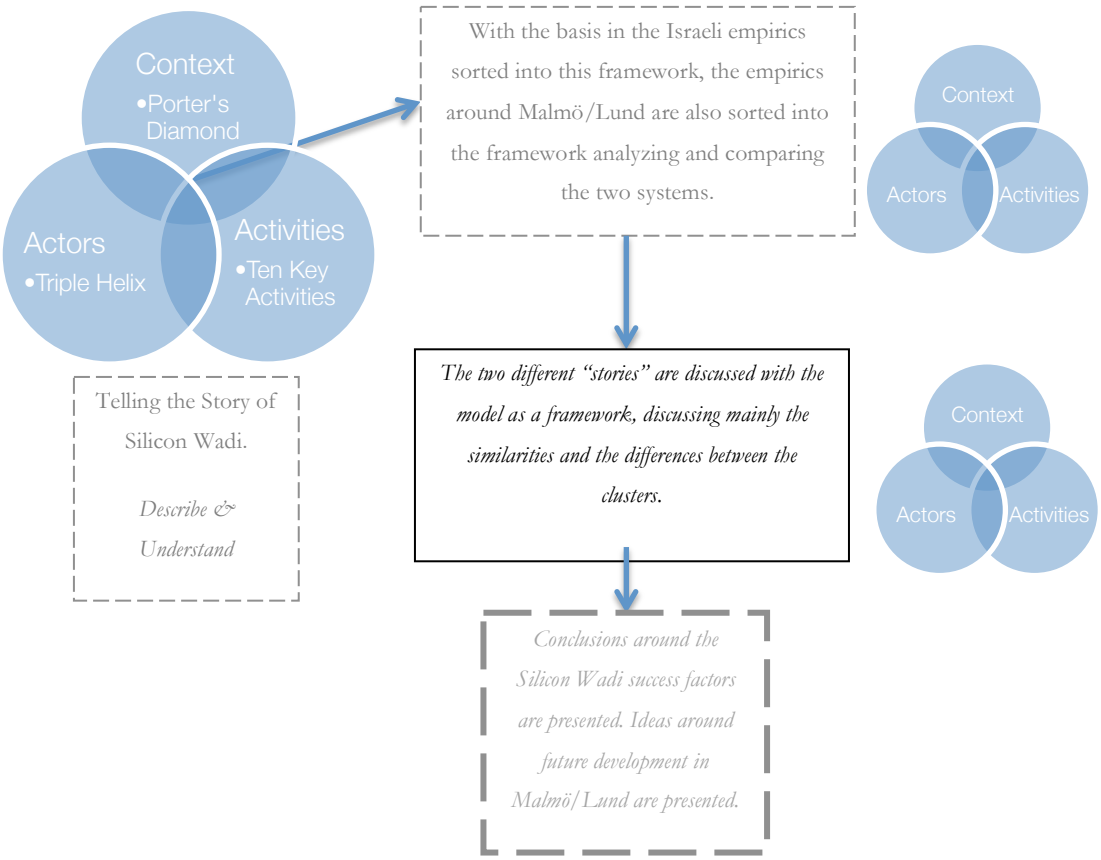


Figure 15: The Innovation Ecosystem Model as applied in this chapter.

Israel has come a long way in creating a vibrant innovation ecosystem. Malmö/Lund is also considered one of the most promising innovation regions in the world according to

OECD[153]. What can be learnt from Silicon Wadi in order to more proactively meet the future in Malmö/Lund?

From the previous analysis one can find several areas that need to be addressed and improved in order to create that innovative, creative, attractive and vital region that politicians, inhabitants, entrepreneurs, public and private business managers as well as university employees are looking towards. The similarities and differences between the two systems are discussed in this chapter.

When comparing the two different clusters in Silicon Wadi and Malmö/Lund a number of similarities and differences occur. They are presented below sorted into the structure of the analysis model used in earlier chapters as shown in the figure below.

7.4.1 Context

7.4.1.1 Geography

Silicon Wadi is situated in the central part of Israel, containing the nation's three main cities, Haifa, Tel Aviv and Jerusalem. In Sweden, Stockholm is the main city and political power, finance, and business headquarters are situated here, making Malmö/Lund more of a peripheral area in Sweden. This is affecting the systems in a number of ways. The main legislative power in Sweden is concentrated in Stockholm hence Malmö/Lund is a region with a notable geographical distance from the main legislative authorities. Above this, Malmö/Lund also faces the political intervention from three other public organizations, Skåne Regional Council, the City of Lund and the City of Malmö. Hence, Malmö/Lund has more power in regional innovation issues, but is at the same time governed by the national policies and laws enacted in Stockholm.

In Israel, the center of Silicon Wadi is in Tel Aviv. The city is the strongest financial area in the country and a 30-40 minutes car drive away lays Jerusalem with the legislative authorities. Due to the country's smaller size it seems like the regional and local political levels in the country does not affect the innovation policies as much as is the case in Sweden. Hence, a lot of the lessons learned from Silicon Wadi reflect the entire nation's innovation system, many of the conclusions in the following sections therefore are applicable on a national level. However, Malmö/Lund and the Skåne region could be

[153] OECD, *OECD Territorial Reviews: Skåne, Sweden 2012*, OECD Publishing, 2012, p.101

functioning as a prototype region where experiments and novel policies can be tested. The region also has the possibility to lead by example and form an opinion around innovation affecting the rest of Sweden.

The home markets of the two countries are similar in size population-wise but Israel has the disadvantage of being surrounded by states with which the nation is in conflict.

7.4.1.2 Human Capital

Both Malmö/Lund and Silicon Wadi have a high number of the labor force employed in so-called human capital intense industries. The industry bases are also similar, with ICT clusters in both regions alongside cleantech companies and biotechnology firms. In that sense the regions are quite similar.

The main differences when it comes to human capital are cultural and derived from specific factors in each country. The military service in Israel is such a factor that teaches young adults complex leadership, teamwork and cutting edge technology skills. The fear of always being in conflict is another very specific trait in Silicon Wadi that creates an omnipotent stress leading to the fact that the entire nation is kept on their toes.

Furthermore, the flat organizational structures and low hierarchy found in Israel are somewhat similar to the Swedish organizations. However the Swedish culture can be said to be more consensus driven, while the Israeli seems to be more challenging and debate-centered. The constant challenging of authorities and peers combined with an aptitude of working in smaller and flexible teams makes the Israeli culture suitable for startup companies and entrepreneurship. In contrast, the Swedish system with historically high reliance on public services and large corporations might have created a more risk adverse culture biased towards security rather than entrepreneurship.

There are also differences in the research bases in the two countries. In Israel there are industrial, academic and military research stocks as well as knowledge utilized from immigrants, mainly the ones from Russia. In Malmö/Lund there is a strong academic research base that will grow even larger with the establishment of ESS and MAX IV. However, there are tremendous challenges as well as opportunities in integrating well-educated foreign-born people in the Malmö/Lund region and later in the innovation system.

7.4.2 Actors

In the actors field there are many similarities in the composition of the innovation systems. Both countries have approximately the same type of organizations in their respective innovation system, what really differs though lies in what they do and how they do it.

In the case with Silicon Wadi the OCS is the main organization for innovation and policy concerns. The same goes for Malmö/Lund with VINNOVA that is supposed to be the main organization for innovation systems in Sweden. However it seems like, except from VINNOVA, there are several other organizations performing overlapping and sometimes competing activities. It seems like the Israeli innovation system is more coherent and that the actors are created more deliberately with a certain focus and a clear strategy. The ownership also seems to shift over time in the sense that the market takes over after the government has initiated policy programs and activities, for example Yozma. The actors in the support system in Israel also seems to have more commercial incentives with incubators investing their money in the firms they choose to collaborate with, with the purpose to generate money for the incubator fund.

In Malmö/Lund complex ownership structures are highly prevalent. The science parks, incubators and investment funds are often owned by many different parties, private and academic as well as local, regional and national organizations. This might create a problem with the governance of these organizations. At the same time it may provide the different owners with a broader view of how the jointly owned organization is managed.

Finally, there is one major difference from an actor viewpoint that is the VC firms. In Silicon Wadi there are today 70 active VC funds with their offices in Israel as well as 220 international VC funds actively seeking investment opportunities. In Malmö/Lund there are no VC funds according to SVCA, the Swedish Venture Capitalist Association, except from the state owned TeknoSeed I and TeknoSeed II. What is needed now, however, is not more capital but rather more competent capital that comes with connections to markets abroad. Furthermore, the venture capitalists must be met by cutting edge companies and competent entrepreneurs.

7.4.3 Activities

The main activities performed in the different innovation systems are quite similar, although with a few distinct differences.

The Israeli government has been much more active in creating policies fostering foreign trade such as BIRD, LECI and LEIRD. The motivation behind all these policies for foreign intervention in R&D, industry collaborations and access to capital might stem from the isolated geographic location of Israel with enemy states all around the nation. R&D activities also differs in another aspect, namely in the variety of actors performing it. In Israel, as have been mentioned before there are extensive R&D performed in the military, in large corporations as well as in the universities. Sweden also has these different actors performing R&D, but in Malmö/Lund, most research stems from Lund University. The military R&D has one purpose, to better be able to defend ones country, the academic has one, to break new grounds and go beyond knowledge borders, and the industrial has one purpose, to help companies grow their market share and outperform the competition. All these purposes combined might provide the Israelis with a rare R&D-activity-dynamism that is rare in other ICT clusters.

The differences in the more market-oriented activities within the incubators have been much elaborated upon earlier in the discussion and they as well constitute a major difference.

8. Conclusion

In previous chapters the different sub purposes have been elaborated upon. In Chapter 4, The Innovation Ecosystem Model, *the sub purpose of creating an analysis framework was fulfilled in the creation of The Innovation Ecosystem Model. In Chapter 5,* The ICT Cluster in Israel's Silicon Wadi, *the sub purpose of understanding Silicon Wadi was approached. In Chapter 7,* The Innovation Ecosystem Model in Practice, *the differences and similarities between the systems was elaborated upon, fulfilling the sub purpose of benchmarking between the clusters.*

This chapter focuses on the main purpose. It concludes what have made Silicon Wadi successful, states some development ideas for Malmö/Lund, societal as well as systemic ones alongside some ideas derived from Richard Florida, a well-known professor in urban studies. The sub purpose of how the benchmarking made in Chapter 7 can provide insight for the future of the cluster in Malmö/Lund is also included and approached in this chapter under the sections The Future of The Cluster in Malmö/Lund and The Future of a Creative Region.

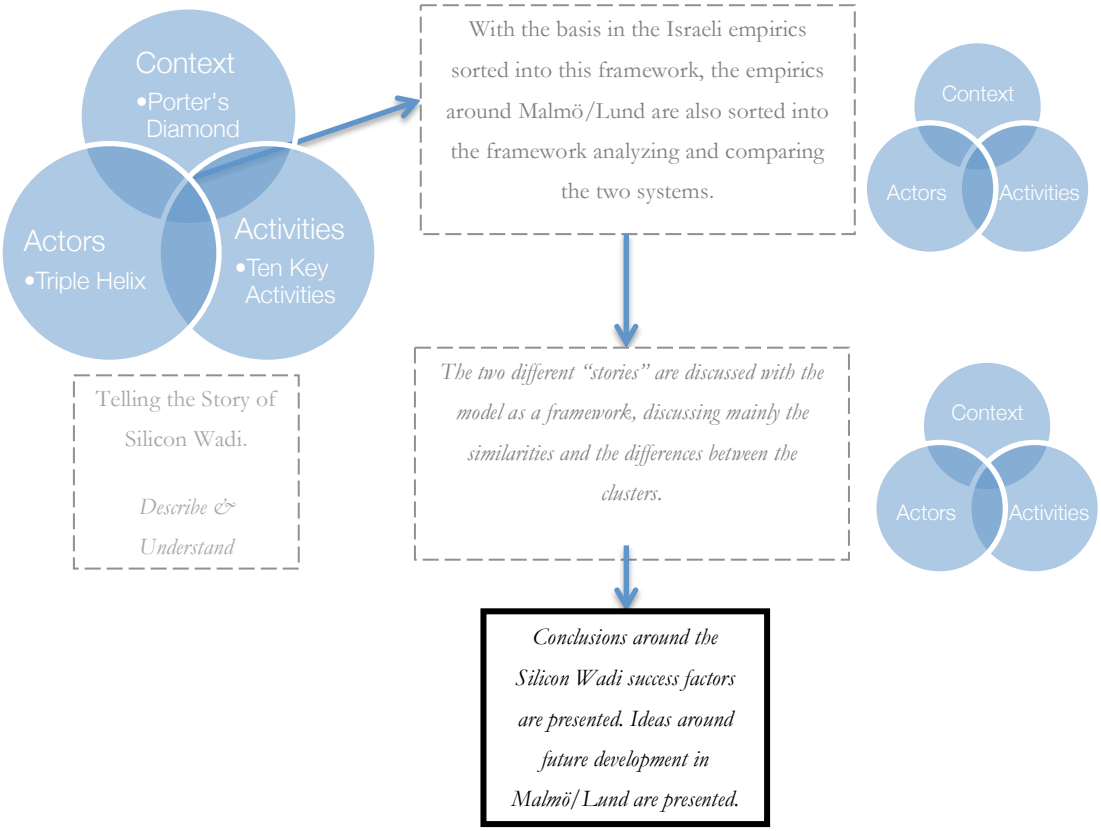


Figure 16: The Innovation Ecosystem Model as applied in this chapter.

8.1 Success Factors in Silicon Wadi

Israel has managed to create a world-class cluster in a small country with enemies on every border and with no natural resources. Many people have asked the question; Why Israel? For me, that was also the first question that came across my mind when I first heard about the high performing Israeli ICT cluster.

As one understand there are no clear recipe for building a successful ICT cluster, but there are, nonetheless, better and worse ways to do it. Furthermore, the creation of a high performing innovation ecosystem looks different in different geographical locations and in different cultural contexts. In this section some of the factors leading to the creation of the Israeli innovation ecosystem are concluded, some of them specific, others more general.

8.1.1 Focused Government Initiatives

The Israeli government has been rather active when it comes to public policy on innovation. At first, as described by Harel and Avnimelech, 2012[154], the Israeli government tried different initiatives and worked in trial and error mode, in an experimental way. This laid the foundation for the continued work on innovation policy and programs. To a high degree, the initiatives have had a clear purpose, a clear strategy, and distinct goals. The OCS has functioned as a "one-stop-shop" when it comes to innovation and R&D and it still plays an instrumental role in the innovation system. Other important policy decisions and programs have been LECI, BIRD, LEIRD, Yozma, Magnet and the Technological Incubator program.

The fact that the government initiatives have been focused might also have made them successful. The realization of when to back out and let the market take care of things might also have been a success factor in the different policy programs. The different policies have been successful and created a good soil for innovation, capital investments, international relationships and entrepreneurship in the country.

8.1.2 Well Developed Capital Markets

Israeli entrepreneurs have access to both domestic and international capital. The Yozma program sparked the VC industry and in 2011 546 companies in Israel raised $2.14

[154] Gil Avnimelech et al., *Global venture capital 'hotspots': Israel,* Handbook of research on venture capital, Volume 2, Cheltenham, Edward Elgar Publishing, 2012, p. 211

billion. The access to capital is of utter importance when it comes to commercializing inventions. From a bank monopoly during the 80's the country now have around 70 VC funds with offices in Israel. Above this, 220 international funds are actively seeking investment opportunities in the country. Nevertheless, this steady stream of capital would not have been possible without a well-functioning R&D and education system in the country, bringing ideas and inventions, the raw material, into the innovation process. Nor would it have been possible without competent entrepreneurs bringing the inventions to the market.

The Yozma program not only created a vibrant capital market, but also international attention around the Israeli innovation system and the possibilities presented in the nation. However, the capital market in Israel is nearly over-dependent on foreign capital, hence vulnerable to economic downturns in the world economy.

8.1.3 Commercialization Infrastructure

To be able to reap the benefits from the extensive R&D investments being made there is a well-established commercialization infrastructure in place in Israel. The main organizations in the infrastructure are Technology Transfer Offices at the universities, and incubators spread over the entire country. It seems like the commercialization infrastructure in Israel is quite well tuned. A reason for this might be the commercial focus and the entrepreneurial drive these organizations seem to have. The incubators for example works more like seed funds, investing in all the companies they accept in their programs. This might create incentives towards carefully screening the market and signing the most promising companies and also towards giving them high-quality services during the program in order to make a profitable exit when the companies leave.

The incubators and the TTO's have created a clear path for companies in the seed stage and provide capital, physical office space, and advice on the path of development towards a more mature company.

8.1.4 R&D and Education

With the early realization that knowledge was to be the main asset for Israel, the government has been investing heavily in R&D and education. In 2010 Israel was the country with the highest public spending on R&D, 4,25 %, according to OECD. Add to

this the investments being made from multinationals into their research facilities in Israel and the military R&D.

The Magnet program has been important in establishing collaboration between academia, the business sector and the public sector and to foster a multitude of research on pre-competitive technology. The program is still running alongside laws such as LEIRD that also support governmental investments in R&D.

The heavy investments in R&D and education have created a broad base of knowledge in different forms, University R&D, Multinational R&D and Military R&D. Above this the Israeli government has been quite successful in integrating well educated researchers arriving as immigrants to Israel, creating yet another source of R&D. The R&D and education system is what provides the raw material to the innovation processes.

8.1.5 Military

The military service is a very specific factor influencing the Israeli innovation system. Besides teaching young people technology and leadership it also creates a nationwide dense network between the people in Israel.

The military culture is reflected in the business sector in Israel in different ways. The high teamwork capabilities and the experimental and value neutral attitude towards performance are two examples.

The military service has managed to create great preconditions for startup companies, teaching complex leadership and cutting edge technology skills. It throws young adults into situations of high complexity, where a decision can mean life or death to oneself and one's peers. An organization like this, never meant to instill an entrepreneurial mindset into young people, have managed to foster high levels of responsibility, maturity and a goal oriented do what it takes-attitude into the majority of Israeli citizens.

8.1.6 Israeli Culture

The Israeli culture has also been of importance in shaping the competitive ICT cluster in Israel. The culture seems to be suitable for entrepreneurship and innovation with its special traits such as the encouragement to challenge and debate both peers and authorities. Furthermore, there are also the preferences towards working in small flexible organizations adding to the great fit between entrepreneurial firms and the culture.

The collective values are also important for the shaping of the Israeli culture. This might stem from the socialistic roots of the nation. The military, mandatory for both men and women today fosters the collective identity and instills a shared purpose into the soldiers.

Also the omnipresent stress of being under attack is a cultural mechanism that keeps the entire people on their toes. The dark chapters from the history of the Jewish people have also fostered an idea that the people need to take care of, and provide for themselves.

8.1.7 International Networks

The Jews dispersed in the Diaspora, now returned to Israel have been of great importance in establishing links to markets bigger than the domestic. It has also been helpful in establishing access to capital, finance knowledge, support and inspiration from different parts of the world. Besides from the returning Diaspora Jews, many still live in different parts of the world. This is also important in a global context. These people can grant access to capital and open up market links internationally through their connections.

8.2 The Future of the Cluster in Malmö/Lund

There are at least three dimensions that need to be addressed in creating a successful and sustainable cluster. The first dimension is the societal dimension; a cluster built in a well functioning but still dynamic society has better preconditions than one built in a corrupt and malfunctioning societal context. The second dimension is the regional cluster level – the systemic factors in the innovation system, this is the dimension where the *Innovation Ecosystem Model* has been applied in this thesis. Lastly there is the creative dimension, as made famous by urban theorist Richard Florida. These three dimensions are taken into consideration in the following sections. However, the societal and the creative dimension is not something deeper looked into in this thesis but rather ideas and thoughts to be developed further in future research. The creative dimension is further elaborated upon in section *8.3 The Future of a Creative Region in Malmö and Lund.*

8.2.1 Societal Challenges

An innovation system must be built in a functioning society, on a "solid rock", in order to work properly. There are some factors that seem to be important in the creation of a successful cluster, first and foremost there needs to be a focus on the input side of innovation, namely knowledge creation and R&D, one of the success factors of the Israeli cluster. Malmö/Lund has one of the highest ranked universities of Scandinavia in terms of quality. What still seems to exist though is the notion of the so-called Swedish innovation paradox, with high public R&D spending but low results in innovation and economic growth. It seems like the commercialization structure needs to be carefully overlooked and reformed. In the effort of analyzing and suggesting reforms, the Israeli commercialization structure can be a possible role model.

The region also needs to put a lot of effort in raising the quality in the elementary schools and use these as a vehicle for knowledge exploration, creativity and integration.

The integration issues at a broader scale are also a pressing issue that needs to be taken seriously. Primarily the problems facing Malmö today is of importance, since foreign born according to OECD faces much higher unemployment rates and in that way become isolated from the labor market and in the long run also from society. According to the OECD Territorial Review, 2012, this is one of the most important challenges facing the region today. These societal challenges must be addressed in parallel with the

more cluster specific challenges in order to create a vibrant ICT cluster in Malmö/Lund. The more cluster specific challenges are presented in the following sections.

8.2.2 Centralized Coordination and Control

The centralized control of the innovation system as seen in Israel, where the OCS is the main political organization for innovation policy can be a role model for the Swedish authorities when organizing the public initiatives around innovation. Many of the problems in the Swedish innovation system are due to the lack of proper organization. In Sweden the three levels of national, regional and local politics creates uncertainties around who is responsible for what in the innovation system. Hopefully a more centralized innovation agency could lead to a larger degree of coordination and control in the public innovation efforts. It might also lead to less bureaucracy in the overall system. However, it needs to be balanced by local presence of representatives making the organization flexible and adaptable to regional challenges.

8.2.3 Clear Purpose of Public Organizations Involved in the Support System

In Israel the public interventions in the support system has been created deliberately with a clear purpose. In Malmö/Lund there are a lot of organizations involved in the support system. National, regional and local actors all created by the public sector. Many of these organizations perform overlapping and sometimes even conflicting activities. Maybe there is a need for the actors in the support system to be carefully mapped, analyzed and restructured on a national level in order to ensure that the output of all these organizations are satisfactory, to learn from what have been done and get out of the experimentation mode like the Israeli government did during the 80's.

It is important for the state, the universities and the business sector to collaborate, nonetheless, this is not the same thing as fusing different stakeholders into hybrid organizations with fragmented ownership structures. Ownership from many different stakeholders such as the state, universities and private companies might create an organization with conflicting goals from the owners. It might also create a diluted purpose and an unclear strategy due to the different will of the different stakeholders.

As been described by Porter, 1990, nations should specialize in what they do better than others. Maybe this is also true for the actors in the innovation system? What would the

map look like if there were close collaboration but less shared ownership that might lead to confusion? The universities, R&D centers and the education system is creating the raw material in the innovation process. Companies in the region are working towards refining the raw materials into new profitable ventures. In parallel with this process companies arise, providing services and capital to the new ventures. The state is providing the lubricant for the system, making sure the laws and policies support innovation activities and making focused efforts to help where the market is failing, without skewing the competition on the free market.

8.2.4 Better Access to Capital Needed in the Region

There is a need for more capital in the Malmö/Lund region. Today there are no private venture capital firms in the region according to the Swedish Venture Capital Association, SVCA[155]. To be able to create a world class ICT cluster access to finance is of utter importance. As mentioned before there is also a need for more competent capital. In Israel this was solved by the Yozma-program. Yozma both created access to capital and educated Israeli investors in venture capital investment mentored by large international VC-firms. The fund was used as an accelerator for creating the capital market and was then privatized.

Another solution in Malmö/Lund might be to better syndicate business angels into angel groups. An angel group makes it possible for individual business angels with limited capital to consolidate their means and make larger investments. This has been seen in Israel and seems to function fairly well. The importance of syndication and collaboration between business angels was also something debated and discussed during the Venture Capital Forum, hosted by business angel network Connect Skåne in Malmö in February.

8.2.5 More Commercial Drive in Incubators

The Israeli incubators work as a seed fund investing in all the companies they choose to work with. Hence they have a strong financial incentive to create profitable and market oriented startup companies that provides a return when exiting the incubator. The incubators also focus a lot on providing the incubator companies with international connections and access to capital when they are ready to move into expansion phase. The incubators in Malmö/Lund can look at the incubators in Israel for inspiration on

[155] SVCA, Members in Malmö, http://www.svca.se/MemberSearch?type=Active, 2013-03-12

how to work more extensively with growth issues, fundraising, and with a more commercial mindset.

8.2.6 International Collaboration

Israel has been forced to work on a global market from the start because of their geographic location in between countries they are in conflict with. Sweden also has a small domestic market and collaborates with actors on a global basis, but there are improvements to be made, especially when it comes to attracting foreign VC[156]. Malmö/Lund has a very beneficial geographic location with Scandinavia's largest airport within a short distance and access to Copenhagen through the Öresund Bridge, hence suitable for making international business.

To foster more international collaboration, a wise way to start would be to manage the connection with Copenhagen in a better way. Today there are a number of obstacles in creating an integrated metropolitan area such as tax issues. A well functioning cross border collaboration established here can be seen as a prototype for international collaboration with other nations. A closer collaboration with the Danish side of the Öresund region would also solve some issues around access to finance, since the Danish capital has a number of venture capital firms active on a global market.

8.3 The Future of a Creative Region in Malmö and Lund

The thesis so far has focused a lot on the "technical" or systemic aspects of building a successful cluster and the constitution of one, with examples both from Silicon Wadi and Malmö/Lund. This section will elaborate more on the soft aspects in creating an innovative and creative milieu. This section builds upon the author's own observations from living in the region during the latest eight years, from working in the innovation system during two years and from studying at Lund University during five years. The observations are discussed through a lens of Richard Florida's, 2001, theories around the creative class.

Richard Florida describes in his book The Flight of the Creative Class, 2001, the future of economic development and regional growth. In a world where creativity is the most important raw material in an immaterial production process, he means that the creative

[156] Maria Montgomerie, *Svenskt internet/media behöver internationellt riskkapital*, Industrifondennytt, Industrifonden, 2013 p. 3.

class is a driving force in economic growth[157]. The creative class is made up of workers in fields spanning science and technology, business and management, healthcare and education, and arts, culture and entertainment. In 2011 Sweden was ranked number one on the Creativity Index[158], hence Sweden is a forerunner in this new metric of measuring economic development and growth. The index builds on three parameters, Technology, Talent and Tolerance, the three main building blocks in building a creative milieu attracting the creative class according to Florida.

There are many possibilities to further make Malmö/Lund an "attractive" talent magnet in order to foster economic growth. In his book Richard Florida describes what makes a location attractive in the eyes of the creative class. While Malmö/Lund already are attractive places to live and work, it is important to understand what makes a location attractive in order to combine the systemic, more technical, aspects of creating a successful cluster with these softer factors. To understand and being able to combine the two perspectives might give the region of Malmö/Lund a competitive advantage in the global competition for creative talent.

A place's attractiveness can be described as a number of aspects. Florida, 2001, lists the following aspects[159], *Broad Labor Markets, Lifestyle, Social Interaction, Diversity, Authenticity, Identity and Place Quality.*

8.3.1. Broad Labor Market

Creative people change employers every once in a while. The broader the labor market the more attractive the place is for creative people. In Malmö/Lund there is a broad labor market spanning many different sectors. It is important to keep the labor market broad and not specialize too much in a particular industry.

8.3.2. Lifestyle

People in the so-called creative class tend to move to places not for a particular job but for a particular lifestyle. People expect to find great music scenes, art scenes, technology scenes, sports scenes etc. The more diverse the supply of components in a modern life style, the more attractive a place becomes.

---

[157] Richard Florida, *Den kreativa klassens framväxt*, Göteborg, Daidalos, 2001, p. 31
[158] Richard Florida et. al., *Creativity and Prosperity: The Global Creativity Index*, Martin Prosperity Institute, 2011, p. 15.
[159] Richard Florida, *Den kreativa klassens framväxt*, Göteborg, Daidalos, 2001, pp. 268-279

8.3.3 Social Interaction

An attractive place needs to have so called third places, meeting places that is not the office or people's homes, such as cafés and restaurants, hence it is important to keep the vivid city centers in Malmö/Lund.

8.3.4 Diversity

The creative class is attracted by diverse places, places with different nationalities and cultural expressions. In this Malmö/Lund has great potential. Unity needs to be reached through diversity and differences, not through standardization and uniformity.

8.3.5 Authenticity

Authenticity is also important for the creative class, authenticity as in genuine and as in the opposite of undistinguished. In Tel Aviv there are the architectural areas of The White City a place that creates a genuine character. In Malmö one can find Möllevångstorget and Gamla Väster with their old architecture and vital street life, in Lund one can stroll on the old streets of Kulturkvadranten or find oneself going out on one of the many student nations. These authentic places within a city or a region are important to keep as they attract creative people.

8.3.6 Identity

People today identify themselves with the places they live. Hence, it is important to keep the city or region different from others and to create an identity for a place. Malmö has been successful in doing this rebranding their city as the transformed working class city and Lund has its strong identity in the university. These identities needs to be communicated and developed further in order to foster creativity and innovation.

8.3.7 Place Quality

A place's quality is expressed in three different facets, all important in creating an attractive city or region.

What is: A combination of built and natural surroundings, creating a place suitable for a creative life.

Who is: A diversity of people interacting and creating possibilities for you to interact and find a place in society.

What is happening: Vivid cultural life and street life, café culture, art, music and people engaged in outdoor activities; an array of creative activities to participate in.

8.3.7 The Three T:s – Technology, Talent and Tolerance

Further on Florida, 2001, states that economic growth and innovation stems from a mixture of Technology, Tolerance and Talent. One or two of these T:s are not sufficient but a creative place needs a mixture of all of these factors. Technology is important to be able to create truly innovative solutions, Talent is important because talents are the ones creating these solutions. The last T, Tolerance, is important because a place where a multitude of ideas and ways of life are tolerated is a place with a higher probability to attract diverse talent.

All the factors mentioned in this section is of importance in creating an attractive place as complementary soft factors to the more technical or hard systemic factors when striving to create a more creative and innovative milieu in a region. It is important for the region of Malmö/Lund to thoroughly think through dimensions such as place quality in order to attract more creative people and in the long run foster even more innovation.

When combining the hard factors, the policy and program focused factors – the lessons from Silicon Wadi, with the soft factors, like Florida's theories around the creative class, there is a good chance that the ICT innovation cluster in Malmö/Lund can meet the future as a strong and creative region with dynamic economic activity and growth.

9. Knowledge Contribution and Future Research

This chapter is a final reflection upon the work that has been done in this thesis and the contribution it has made to both academy and industry. Finally it suggests some areas of future research.

9.1 Knowledge Contributions to Academia

The overall understanding of the ICT cluster in Silicon Wadi, the history behind it and how it has been organized is one of the main contributions to academia. Further on, the insights derived from the benchmarking and comparison between the cluster in Israel and the one in Southern Sweden are also to be seen as a main contribution.

9.1.1 Framework for Analyzing and Comparing Clusters

The *Innovation Ecosystem Model* combines three important facets of a cluster, Context, Actors and Activities. These three facets are derived from Edquist's theories around innovation systems and adapted to fit with recognized theoretical models. Context is analyzed through Porter's diamond, Actors through the triple helix framework and lastly Activities through Edquist's framework of the Ten Key Activities.

For academia, this provides a structured and focused way to map and understand a cluster. However, the analysis model does not provide a quantitative base for analysis but rather a qualitative and conceptual base for understanding a cluster.

9.1.2 Cross-Disciplinary Study of Clusters

This thesis has been studying the cluster from a number of perspectives such as policy, cultural, technological, and economical perspectives. This thesis shows that in order to understand an innovation cluster, there is a need for cross-disciplinary studies. Innovation always takes place in a context. Clusters are always created in a context. This context is of complex nature and it needs to be looked upon from many different perspectives to get a better understanding.

In an increasingly complex world it is important for Industrial Engineering and Management students, in particular the ones specializing in innovation, to understand the different disciplines affecting innovation and the creation of innovative clusters.

9.2 Knowledge Contributions to the Industry

There are some main contributions to the industry in this thesis, though it has come to be of a rather political nature. For companies aware of social responsibility the thesis can provide insights in how to work responsibly in fostering regional innovativeness. Nonetheless, for consulting companies involved in consulting political organizations the thesis can inspire debate with clients, resulting in projects where novel solutions to overcome innovation obstacles can be proposed.

Furthermore, the thesis might be an eye opener for Swedish ICT companies looking for international business partners. The Israeli ICT business sector is highly advanced and might present Swedish companies with innovation and collaboration opportunities not to be found anywhere else in the world.

9.3 Knowledge Contributions to the Political Sphere

Policymaking is an integral part of making a cluster successful, where well-designed policies can create an environment where entrepreneurship and innovation thrives. Below some of the main contributions for policy makers are presented.

9.3.1 Organization

The Israeli cluster has been organized much around one "innovation agency", the OCS. The Swedish innovation system is in need of a more organized structure. Some of the ideas around how the Israeli cluster is organized might work as a blueprint also in Sweden. Hopefully the thesis can also contribute to a higher awareness in the importance of figuring out how the public sector can be able to organize themselves in order to facilitate the innovation process between actors in the cluster.

9.3.2 Venture Capital

This thesis describes how the Yozma-program created a VC-industry in Israel. There is a pressing need for more venture capital in Malmö/Lund. Hopefully the description of the Yozma-program in this thesis can contribute with knowledge on how to attract more VC to the cluster.

9.3.3 A Holistic View of a Cluster

Hopefully the thesis will contribute with knowledge that a successful cluster cannot be created only by raising the quality of universities or by lowering taxes or other specific

interventions. They are all important but have to be put in a context and properly prioritized. There are a number of dimensions for the public sector to look over in order to be able to create a good soil for cluster formation. There are societal challenges that has to be solved, systemic challenges and also the aspects from Richard Florida's theories that has to be considered when enacting policies and initiating programs.

9.4 Suggestions on Future Research

The research fields of innovation, innovation systems and clustering of economic activities are broad and there are a lot of interesting areas to be further explored and researched. In this section some suggestions for future research are being made.

9.4.1 The Innovation Ecosystem Model in Practice

The Innovation Ecosystem Model can be applied to a number of innovation clusters in order to better understand them. There are a number of clusters that can be researched; Silicon Valley and Berlin are two examples of clusters that can be further examined.

9.4.2 Characteristics of Successful Clusters

A study could be conducted in order to understand the characteristics of a successful cluster. The goal of a study like that can be to find out if there are any common factors that seem to have contributed to the independent clusters success. It would also be interesting to know if these factors are cluster specific and however they can be created or not.

9.4.3 Analysis of Outcome from Actors Activity in Malmö/Lund

What is the actual outcome of the activities performed by actors in the innovation cluster in Malmö/Lund? This is an interesting topic to research in order to understand what actors and what activities work today, what needs to be improved and what needs to be closed down. This study can be made on a number of different actors in the innovation system such as incubators, public seed funds, and other support organizations.

9.4.4 What is Society's Role in a Cluster?

A cluster is built in a society. To what degree must the society be functioning in order to foster innovation? What is society's role in a cluster? These are examples of questions that can be further looked into in order to better understand the context in which a cluster emerges. To gain a deeper understanding in the societal dimension can be of utter

importance in order to make the role of the public sector in an innovation system more distinguished.

9.4.5 How to Prioritize Public Interventions?

This suggestion is closely related to the previous. In order to better understand why, how and what to do as a public sector actor in a cluster there needs to be a way to prioritize what efforts are important in different development stages of a cluster. A study that prioritizes different public interventions can be of great help when national and local governments around the world enact policies on innovation.

References

Books

Avnimelech, G., Harel, S., *Global venture capital 'hotspots': Israel,* Handbook of research on venture capital, Volume 2, Cheltenham, Edward Elgar Publishing, 2012

Carmel E., De Fontenay, C., *Israel´s Silicon Wadi, The Forces Behind Cluster Formation,* Building High-Tech Clusters, Silicon Valley and Beyond, Cambridge, Cambridge University Press 2004

Dicken, P., *Global Shift, Mapping the contours of the changing world economy*, 5th Ed., London, Sage Publications, 2007

Edquist, C., *Systems of Innovation, Perspectives and challenges*, The Oxford Handbook of Innovation, Oxford, Oxford University Press, 2006

Florida, R., *Den kreativa klassens framväxt*, Göteborg, Daidalos, 2001

Höst, M. Regnell, B. Runeson, P., *Att genomföra examensarbete*, Lund, Studentlitteratur, 2006

Ries, E., *The Lean Startup,* New York, Crown Publishing Group, 2011

Schumpeter, J., *The Theory of Economic Development*, Cambridge, Mass. Harvard University Press, 1934

Senor, D., Singer, S., *Start-up Nation, The Story of Israel´s Economic Miracle,* New York, Hachette Book Group, 2009

Wallén, G., *Vetenskapsteori och Forskningsmetodik,* Lund, Studentlitteratur, 1996

Articles

Asheim, B.T., Coenen, L., *Knowledge bases and regional innovation systems: Comparing Nordic clusters*, Research Policy 34, Elsevier, 2005

Baker D., *Europe's hottest startup capitals: Tel Aviv*, Wired, 2011-08-15, http://www.wired.co.uk/magazine/archive/2011/09/european-startups/tel-aviv?page=all, 2013-01-18

Bohlin, S., *Hett skånskt it-bolag uppköpt i hemlighet,* it24, 2013-02-26 http://www.idg.se/2.1085/1.494408/hett-skanskt-it-bolag-uppkopt-i-hemlighet?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+idg%2FETkj+%28IDG.se%3A+IDG.se+-+100+senaste%29, 2013-02-28

Butcher, M., *UPDATED: Apple buys Polar Rose for a rumoured $29 million*, TechCrunch, 2010-09-20, http://techcrunch.com/2010/09/20/apple-buys-polar-rose-for-a-rumoured-22-million/, 2012-02-28

Connect Skåne, *Vår verksamhet 2011*, Connect Skåne, 2011

Drucker, P.F., *The Discipline of Innovation*, Harvard Business Review, 2002

Dutta, S., Lopez-Claros, A., Mia, I., *Israel: Factors in the emergence of an ICT powerhouse, The Global Technology Report 2005-2006*, Palgrave MacMillan, 2006

Edquist, C., *Design of Innovation Policy through diagnostic analysis: identification of systemic problems (or failures)*, Industrial and Corporate Change, Oxford, Oxford University Press, 2011

Etzkowitz, H., Leydesdorff, L., *The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university–industry–government relations*, Research Policy 29, Elsevier. 2000

Fagerberg, J., *A Guide to Schumpeter*, 2009, http://www.cas.uio.no/Publications/Seminar/Confluence_Fagerberg.pdf, 2012-09-20

Florida, R., Mellander, C., Stolarick, K., *Creativity and Prosperity: The Global Creativity Index*, Martin Prosperity Institute, 2011

Forsknings- och innovationsrådet, Soundingboard Innovation i Skåne, *En internationell innovationsstrategi för Skåne 2012-2020*, 2011

Kaplan, G., *Israel: A High-Tech Haven*, IEEE Spectrum 35, 1998

Lidé, S., *Öresund: A Free Port for Knowledge*, PwC, 2011

Malmö Stad, *Malmöläget*, Stadskontoret Malmö Stad, 2012

Montgomerie, M., *Svenskt internet/media behöver internationellt riskkapital*, Industrifondennytt, Industrifonden, 2013

Nowak, D., *National Innovation Systems – evidence from Israel*, Scientific Problems of Machines Operation and Maintenance, 2011

OECD, *Ministerial report on the OECD Innovation Strategy, Innovation to strengthen growth and address global and social challenges, Key Findings*, OECD, 2010

OECD, *OECD Territorial Reviews: Skåne, Sweden 2012*, OECD Publishing, 2012

Porter, M.E., *The Competitive Advantage of Nations*, Harvard Business Review, 1990

Porter, M.E., *Clusters and the New Economics of Competition*, Harvard Business Review 1998

Satz, L., *Fullt hus innan invigningen, Sydsvenskan*, 2012-06-08, http://www.sydsvenskan.se/ekonomi/fullt-hus-innan-invigningen/, 2013-03-01

Steltzer, I., *The rest of the world can learn a lot from the Israeli formula for growth*, The Wall Street Journal, 2010-01-24. http://online.wsj.com/article/SB10001424052748704509704575019041049672122.html, 2012-12-20

Stenstruup, B., *Tendens Öresund 2012*, Tendens Öresund, 2012

Ström, V., *Oredan kostar miljoner*, Sydsvenskan. 2010-11-27

Svenskt Näringsliv, *Företagens betydelse för Lund*, Svenskt Näringsliv, 2012

Yago, G., Zeidman, B., *Building Israel's Small Business and Microenterprise Sector*, Milken Institute, 2005

Zohar, G., *Bet Your Bottom Dollar*, The Jerusalem Post, 2007-06-28 http://web.archive.org/web/20080203230544/http://www.jpost.com/servlet/Satellite?cid=1182951036437&pagename=JPost/JPArticle/ShowFull, 2013-02-07

Internet Sources

Almi, About, http://www.almi.se/om-almi/, 2013-02-28

Bar-Ilan University, http://www1.biu.ac.il/indexE.php?id=35&pt=1&pid=30&level=2&cPath=35, 2012-10-17

Bar-Ilan University, Facts & Figures, http://www1.biu.ac.il/indexE.php?id=981&pt=1&pid=35&level=3&cPath=35,981, 2012-10-17

BDO Israel, *Doing Business in Israel 2010*, 2010, http://www.bdo.co.il/_Uploads/dbsAttachedFiles/doing_business_in_israel_2010.pdf, 2013-01-16

CIA, *The World Factbook*, CIA, Application on Apple iPhone, 2013

Granot Ventures, http://www.granot-ventures.com/, 2012-10-18

Hebrew University, http://www.huji.ac.il/huji/eng/aboutHU_history_e.htm, 2012-10-17

Hebrew University, About, http://www.huji.ac.il/huji/eng/aboutHU_e.htm, 2012-10-17

Ideon, About, http://www.ideon.se/en/about-ideon/, 2013-02-28

Ideon, Becoming an Ideon Company, http://www.ideon.se/en/about-ideon/becoming-an-ideon-company/, 2013-02-28

Ideon Innovation, About, http://www.ideoninnovation.se/sv/company/15/inkubator, 2013-03-13

iExplore, About us, http://www.iexplore.co.il/index.php/about, 2012-10-18

Industrifonden, About, http://www.industrifonden.se/om-industrifonden, 2013-03-13

Industrifonden, History, http://www.industrifonden.se/om-industrifonden/historia, 2013-03-13

Innovationsbron, About, http://innovationsbron.se/om/, 2012-02-28

Innovationsbron, About the Projects, http://innovationsbron.se/om/projekt/, 2013-02-28

Invest in Israel, *Venture Capital in Israel,* http://www.investinisrael.gov.il/NR/exeres/A19A138D-87A7-416B-8D62-1C968E035E13.htm, 2013-01-21

Israel Ministry of Foreign Affairs, *Economy: Sectors of the Israeli economy*, 2010-11-28, http://www.mfa.gov.il/mfa/aboutisrael/economy/pages/economy-%20sectors%20of%20the%20economy.aspx, 2013-01-17

JVP, About JVP Medialabs, http://www.jvpvc.com/medialabs-about, 2012-10-18

LUIS, About, http://luis.lu.se/en/om_oss/verksamheten, 2013-03-11

LUIS, Portfolio Companies, http://luis.lu.se/en/portfoljbolag, 2013-03-11

Lund University, About, http://www.lunduniversity.lu.se/about-lund-university, 2013-03-01

Lund University, Short Facts, http://www.lu.se/om-universitetet/universitetet-i-korthet, 2013-02-07

Lund University, Strong Research Milieu, http://www.lu.se/forskning/starka-forskningsmiljoer, 2013-03-27

MHBC, About, http://mhbc.se/about_mhbc/, 2013-02-28

Minc, About the Incubator, http://www.minc.se/about_incubator.aspx, 2013-03-13

Minc, Incubator, http://www.minc.se/incubator.aspx, 2013-03-13

Minc, Offer, http://minc.se/offer.aspx, 2013-02-28

OECD Country Statistical Profile: Israel, http://www.oecd-ilibrary.org/economics/country-statistical-profile-israel_20752288-table-isr, 2012-12-18

OECD, Country Statistical Profile: Sweden 2013, http://www.oecd-ilibrary.org/economics/country-statistical-profile-sweden_20752288-table-swe, 2013-02-22

Skåne Regional Council, http://www.skane.se/sv/Webbplatser/skanese/English/, 2013-02-26

Skåne Regional Council, Business and Economic Development, http://www.skane.se/sv/Skanes-utveckling/Ansvarsomraden/Naringsliv__investeringar/, 2013-02-28

Skåne Regional Council, Development of Skåne, http://www.skane.se/sv/Skanes-utveckling/Ansvarsomraden/, 2013-02-28

Skåne Regional Council, Ideon Innovation, http://www.skane.se/sv/Skanes-utveckling/Ansvarsomraden/Naringsliv__investeringar/Samarbeten/Foretagsinkubatorer/Ideon-Innovation/, 2013-03-13

Skåne Regional Council, Marketing of Skåne, http://www.skane.se/sv/Skanes-utveckling/Ansvarsomraden/Marknadsforing-av-Skane/, 2013-02-28

SVCA, Members in Malmö, http://www.svca.se/MemberSearch?type=Active, 2013-03-12

Sveriges Radio, http://sverigesradio.se/sida/artikel.aspx?programid=438&artikel=5414150, 2013-01-21

Technion, About, http://www1.technion.ac.il/en/about, 2012-10-17

Technological Incubator Program, http://www.incubators.org.il/category.aspx?id=606, 2012-10-18

Technological Incubator Program: JVP Media Studio, http://www.incubators.org.il/incubator.aspx?id=1370&catid=576, 2013-01-21

Teknoseed, About the company, http://www.teknoseed.se/default.asp?pId=2, 2013-03-13

Tel Aviv University, About, http://english.tau.ac.il/about_tau, 2012-10-17

The City of Lund, Statistics, http://www.lund.se/Medborgare/Kommun--politik/Kommunfakta/Statistik/Befolkning/, 2013-02-07

The city of Malmö, http://malmo.se/english, 2013-02-07

thetime, About, http://thetime.co.il/about-us/overview.aspx, 2012-10-18

thetime, http://www.thetime.co.il/, 2013-01-22

University of Haifa, http://www.haifa.ac.il/html/html_eng/welcome.html, 2012-10-17

VentureLab, About, http://www.venturelab.lu.se/page.php?id=1, 2013-03-13

VentureLab, Incubator Companies, http://www.venturelab.lu.se/page.php?id=11, 2013-03-13

VINNOVA, About, http://www.vinnova.se/en/About-VINNOVA/, 2013-02-26

VINNOVA, Services within ICT, http://www.vinnova.se/sv/Var-verksamhet/Tjanster-och-IKT/, 2013-03-27

Weizmann Institute, http://www.weizmann.ac.il/, 2012-10-18

Xenia, About Us, http://xenia.co.il/AboutUs, 2013-01-21

Interviews

Lars Persson, CEO Sydsvensk Entreprenörfond, 2013-03-25

Appendixes

Appendix 1: The Five Phases of Development in the ICT industry[160]

1. The Background Conditions Phase – 1969-1986

During this phase the necessary background conditions for the ICT cluster was laid. The OCS, Office of Chief Scientist, was founded and R&D was heavily invested in. The Innovation and Technology Policy, ITP, also took its form during this phase. The phase was in general characterized by a trial and error experimentation laying the foundation for the next phase.

2. The Pre-Emergence Phase – 1986-1992

This phase of the pre-emergence of the ICT industry occurred much due to three specific factors:

1. Stabilizing macro environment stemming from the 1985 stabilization plan
2. The ongoing technological revolution
3. The significant diffusion of R&D and innovation capabilities into the business sector

In the end of this phase the demand side for VC was in its infancy with startups demanding capital for technological development and expansion.

3. The Emergence Phase – 1993-2000

This phase came to develop the supply side of VC, mainly because of the Yozma-program, a government initiative with $100 million divided into ten VC-funds. The goal with the funds was to attract foreign VC investments to Israel. Yozma is described more in detail in the next section under *Governmental Policies*. This phase can be divided into three sub-phases:

1. Fluid sub-phase 1993-1995 – Experimentation and learning around startup organizations and VC policies.

[160] Gil Avnimelech et al., *Global venture capital 'hotspots': Israel,* Handbook of research on venture capital, Volume 2, Cheltenham, Edward Elgar Publishing, 2012, p. 211

2. Rapid growth 1995-1998 – Growth of industry and creation of supporting companies as well as multinational R&D establishments.
3. VC bubble 1999-2000 – Due to the dot.com bubble the industry phased a crisis.

4. The Crisis Phase – 2001-2003

The crisis phase followed as a result of the global dot.com bubble, which also effected Israel's VC fueled high-tech growth between 1993-2001. The OCS reevaluated and began to upgrade the ITP to a wider spectrum.

5. The Post-Emergence Phase – 2004-2008

The realigned ITP strategy and the crisis resulted in several new ITP programs during this phase, many of them started during the crisis phase:

- Tnofa 2000 – Pre-seed support for inexperienced entrepreneurs
- Magneton 2001 – Providing grants for collaboration between industry and academia, part of the Magnet program
- Heznek 2003 – Seed finance risk sharing through governmental support
- Nofar 2004 – Promoting industry-academia collaboration within bio technology, part of the Magnet program
- Katamon 2004 – Supporting water filtration projects, part of the Magnet program
- Tamir 2004 – Knowledge transfer from multinationals to startup companies
- Nataf 2005 – Supporting nano technology R&D projects
- 2006 – Enhancing R&D in traditional industries
- 2010 – Biotechnology VC funds
- 2011 – Guarantees for Israeli pension and insurance funds in VC's and the Angel Law

Appendix 2: Important Government Programs

LECI – 1959-

LECI entered into force in 1959 and has since then been revised at several occasions. The law favored projects with high value adding and marketing capabilities in local but also international markets. Companies with eligible projects were approved by a department at The Ministry of Industry, Trade and Labor and gained the status of Approved Enterprises or Beneficiary Enterprises. This put them in a position able to receive governmental grants and/or tax benefits in different forms. The law was deliberately biased towards foreign investors in order to draw international companies to Israel. It functioned well and during the 60's and 70's companies such as IBM, Motorola and Intel established a presence in Israel[161].

OCS – 1969-

The OCS was founded in 1969 and is today responsible for overseeing all government sponsored R&D in the Israeli industry. The OCS is organized under the Ministry of Industry, Trade and Labor[162]. The programs and activities of the OCS can be seen in Table 1.

	Pre-seed	Generic R&D	Competitive R&D
National	• Technological Incubators • Tnufa • Nofar	• Magnet • Magneton	• Industrial R&D projects • Seed Fund
International		• ISERD	**MATIMOP** • Eureka • Bi-National Funds • Bi-National Agreements

Table 1: The OCS's different programs and activities

BIRD – 1977-

The Binational Industrial Research and Development Foundation, BIRD, was founded in 1977 in order to establish a connection between American companies and Israeli firms.

[161] Soumitra Dutta et al., *Israel: Factors in the emergence of an ICT powerhouse*, The Global Technology Report 2005-2006, Palgrave MacMillan, 2006, p. 9
[162] http://www.moital.gov.il/CmsTamat/Rsrc/MadaanEnglish/MadaanEnglish.html, 2013-01-10.

The idea was to gain market access to the American market through collaboration projects where an American firm marketed and distributed the product and the Israeli firm developed and manufactured it. BIRD contributed 50 % of the estimated budget of the research project. Many of the projects were successful but no research of BIRD's impact has been done. The overall slow growth of the economy, however, suggests that BIRD in itself was insufficient to create economic growth[163]. On the other hand Senor and Singer (2009) points out that BIRD up to date has invested $250 million in 780 projects, resulting in $8 billion in direct and indirect sales[164].

LEIRD – 1984-

LEIRD is still today the primary legal framework for government support to industrial R&D[165]. The law is in many ways similar to LECI when it comes to the desired outcomes. The focus lies in the development of a science-based and export oriented industry. The OCS administers LEIRD and the two are the main instruments for implementation and administration of government R&D policy.

Inbal – 1992-1998

Inbal was a government owned insurance company founded in 1992. The idea behind the initiative was to provide a 70 % guarantee to VC funds traded on the Israeli stock market, TASE, in order to protect the downside of investments. The result of the Inbal program was four VC funds and the initiative is considered a failure. The failure was due to several factors, a bureaucratic organization, low valuation of the funds on the market and the lack of upside incentives for investors. However, the failure of Inbal and the lessons learned from it, was important when creating the more successful VC policy program Yozma.

Yozma – 1993-1998

The Yozma program was initiated in 1993 with the purpose to attract foreign VC capital to Israel, to provide international know-how around VC to Israeli investors and to create a vibrant VC industry in the country. The government invested $100 million in ten funds

---

[163] Catherine de Fontenay et al., *Israel´s Silicon Wadi, The Forces Behind Cluster Formation,* Building High-Tech Clusters, Silicon Valley and Beyond, Cambridge, Cambridge University Press 2004, p. 56
[164] Dan Senor et al., *Start-up Nation, The Story of Israel´s Economic Miracle,* New York, Hachette Book Group, 2009, p. 163
[165] Soumitra Dutta et al., *Israel: Factors in the emergence of an ICT powerhouse*, The Global Technology Report 2005-2006, Palgrave MacMillan, 2006, p. 9

where the government provided 40 % of funding with easy purchase clauses for investors[166]. The government's investments were leveraged by private investments of $150 million[167]. The favorable background factors at its implementation played an instrumental role in the success of the program, as well as the lessons learned from the failing Inbal program. The government's industrial R&D support program, the restructuring of military R&D, the influx of highly skilled Soviet immigrants and the opening up of global innovation networks due to the revolutionary ICT technology at the time were all influential background factors contributing to the overall success of Yozma. Harel and Avnimelech, 2012, further list a number of what they call critical dimensions for Yozma's successful implementation:

- **Autonomy:** The funds were Independent Israeli Limited Partnership Companies
- **Focused investment strategy:** Yozma had a clear focus on investments in early-stage, high-technology companies
- **Critical mass of available money:** The $100 million government funds were leveraged by an additional $150 million in private capital investments
- **Investment knowledge acquisition through partnership:** Each Yozma fund had to have a foreign, reputable investor as a limited partner as well as Israeli VC novices learning from the foreign investor
- **Strong incentive to the "upside":** Each of the funds in the program had a call option for the governmental shares at cost of a five year period
- **Planned privatization:** From the start it was clear that the funds were to be privatized in five years, starting in 1998.
- **Timing:** The implementation took place in the exact right phase, after the background and pre-emergence phases at the very beginning of a global rapid-growth phase in leading technology exchange markets and in the high technology industry.

Harel and Avnimelech, 2012, mean that the direct and indirect impact of the funds was very important to spur the Israeli VC industry. According to figures they derived from the Israeli Venture Capital (IVC) datasets the direct impact was as following: the funds

---

[166] Catherine de Fontenay et al., *Israel´s Silicon Wadi, The Forces Behind Cluster Formation,* Building High-Tech Clusters, Silicon Valley and Beyond, Cambridge, Cambridge University Press 2004, p. 63
[167] Gil Avnimelech et al., *Global venture capital 'hotspots': Israel,* Handbook of research on venture capital, Volume 2, Cheltenham, Edward Elgar Publishing, 2012, p. 216

raised in total $263 million, Yozma invested in 164 start-up companies of which had an exit rate of 48 % compared with the Israeli average startup exit rate of 14 %, in the years 1993-2000.

The indirect impact is also impressive according to the authors. During the three years prior to Yozma's implementation the number of startups created were around 200 companies. The number rose from then on to approximately 440 companies in 1993-1995 with sharp increases every year after that up until 2000[168]. Yozma also attracted a rapid establishment of non Yozma VC funds triggered by the high return rates of the Yozma funds. It also generated significant knowledge spillovers within VC and established a link for foreign investors in Israel.

Magnet Program – 1992-

The Magnet program was initiated to enhance the collaboration between academia and the business sector in Israel. The program offered a consortium of firms and at least one academic institution multi-year grants for three to five years. The government stood for up to 66 % of the proposed R&D budget in a research project carried out by the consortium. The projects were aimed to develop pre-competitive generic technologies. In 2005 there were 31 consortia in Israel[169].

Technological Incubator Program – 1992-

According to Lopez-Claroz and Mia, 2006, technological innovation requires both intellectual and financial input. The intellectual input, described as the "demand-side of VC" by Harel and Avnimelech, 2012, had been historically high in Israel. The problem was in commercializing the findings. With this in mind, and to support the massive influx of Soviet immigrants, the incubator program was initiated. The program was paralleled by Magnet, described above, and the military Computer and Data Communications Network Centre.

With a budget of $24 million 24 incubators were setup in Israel, every incubator responsible for about 10 projects with a budget of approximately $450,000 per year and

[168] Gil Avnimelech et al., *Global venture capital 'hotspots': Israel,* Handbook of research on venture capital, Volume 2, Cheltenham, Edward Elgar Publishing, 2012, p. 218
[169] Soumitra Dutta et al., *Israel: Factors in the emergence of an ICT powerhouse*, The Global Technology Report 2005-2006, Palgrave MacMillan, 2006, p. 11

project[170]. The incubators set out to bridge the early, very risky funding gap with governmental money. The government invested 85 % of the money in the form of soft loans and grants, the rest of it was provided by VC's, the incubator itself or the entrepreneur. In 2001 a privatization process began, the incubators are now privately managed and Mayaan Ventures and Xenia are today traded publicly[171].

The result of the incubators has been clear. The success rate, success defined as the ability to raise private capital and to operate for at least two years, was around 50 %. For American startups the same number is 10 %[172]. On the programs web page one can read that the program has funded 1400 companies between 1991-2009, of which 1200 matured and left the incubator. The government's investments have been $500 million. Adding to this, private investors have done an additional $3 billion of cumulated investments[173].

Appendix 3: Fact about Israeli Universities

The facts have been collected from each university's webpage.

Bar-Ilan University

General background

Bar-Ilan University is the fastest-growing institution of higher education in Israel. Those pursuing their BA, MA and PhD degrees on our award-winning campus just outside Tel Aviv and in our six regional colleges across Israel are joined by thousands more who are enrolled in certificate and enrichment programs, including the largest in-service teacher training program in Israel.

The University is comprised of students from all over Israel; secular and religious; Jews and non-Jews; Sabras and new immigrants. Included within the BIU family, as well, are a multi-faceted academic faculty and administrative staff. Their confluence represents a mosaic of the State of Israel, providing a unique atmosphere for open exchange of ideas

---

[170] Soumitra Dutta et al., *Israel: Factors in the emergence of an ICT powerhouse*, The Global Technology Report 2005-2006, Palgrave MacMillan, 2006, p. 11
[171] Gil Avnimelech et al., *Global venture capital 'hotspots': Israel,* Handbook of research on venture capital, Volume 2, Cheltenham, Edward Elgar Publishing, 2012, p. 222
[172] Soumitra Dutta et al., *Israel: Factors in the emergence of an ICT powerhouse*, The Global Technology Report 2005-2006, Palgrave MacMillan, 2006, p. 12
[173] Technological Incubator Program, http://www.incubators.org.il/category.aspx?id=606, 2013-01-24

and embracement of the "other." Diversity is a key on the BIU campus, and tolerance and civility our operating code.

It is this ability to fuse a reverence for Jewish legacy and heritage with the rigors of academic study, which makes Bar-Ilan University like no other[174].

Rank on Times Higher Education

Not on the list.

Founded in

1955

Faculties

- The Faculty of Medicine in the Galilee
- The Faculty of Jewish Studies
- The Faculty of Humanities
- The Faculty of Social Sciences
- The Mina and Everard Goodman Faculty of Life Sciences
- The Faculty of Exact Sciences
- The Faculty of Law
- The Faculty of Engineering

With additional regional colleges:

- The Safed College
- The Western Galilee College (Acre)
- The Jordan Valley College (Tzemach)
- The Ashkelon Academic College
- The Haredi College of Bnei Brak (Mivchar)
- The Haredi College of Jerusalem

Number of students

[174] Bar-Ilan University, http://www1.biu.ac.il/indexE.php?id=35&pt=1&pid=30&level=2&cPath=35, 2012-10-17

32 083[175] including regional colleges

Technology Transfer Offices

Bar-Ilan R&D

Hebrew University

General background

The dream of establishing a "University of the Jewish People" in the Land of Israel formed an integral part of the early Zionist vision. With the acquisition of the Gray Hill estate atop Mount Scopus, and the laying of the cornerstone for the university-to-be in 1918, the realization of the dream was on its way.

Seven years later, on April 1, 1925, the Hebrew University of Jerusalem was opened at a festive ceremony attended, among others, by leaders of world Jewry including the University's founding father, Dr. Chaim Weizmann[176].

With the reunification of Jerusalem in the Six-Day War of June 1967, work began on restoring and expanding the Mount Scopus campus. In 1981, the historical Mount Scopus campus again became the main home of the University. The University has since continued to grow, with the addition of new buildings, establishment of new programs, and recruitment of outstanding scholars, researchers and students, in fulfillment of its commitment to excellence.

Rank on Times Higher Education

Ranked as number 137.

Founded in

1925

Faculties

- Faculty of Humanities
- Faculty of Social Sciences

[175] Bar-Ilan University, Facts & Figures, http://www1.biu.ac.il/indexE.php?id=981&pt=1&pid=35&level=3&cPath=35,981, 2012-10-17
[176] Hebrew University, http://www.huji.ac.il/huji/eng/aboutHU_history_e.htm, 2012-10-17

- Faculty of Law
- The Faculty of Mathematics and Sciences
- Faculty of Medicine
- Faculty of Dental Medicine
- The Robert H. Smith Faculty of Agriculture, Food and Environment.

Number of students

23 500[177]

Technology Transfer Offices

Yizzum Technology Transfer

The Open University of Israel

General background

In the academic environment in Israel, the Open University of Israel is similar to other universities in its pursuit of excellence and its commitment to superior scientific and scholastic standards. However, it differs in its organizational structure, its curriculum, and its admission requirements.

The Open University is open to all those who wish to study a single course or a battery of courses, or to pursue a full program of study toward a Bachelor's degree. Enrollment does not require matriculation or any other certificate from another educational institution. Though applicants are not required to provide proof of prior scholastic achievements, their academic achievements are the key to their success at the Open University. Along with its open admission policy, the Open University demands of its students personal qualities without which academic achievements cannot be attained: ambition, motivation, perseverance, responsibility and self-discipline. Students are required to study on their own, practice at home, actively participate in group learning activities, and meet course deadlines and requirements.

Since 1996, the Open University has offered programs of study leading to a Master's degree. In contrast to the open admission policy for undergraduate studies, admission to graduate studies is contingent on fulfillment of certain requirements.

[177] Hebrew University, About, http://www.huji.ac.il/huji/eng/aboutHU_e.htm, 2012-10-17

Rank on Times Higher Education

Not listed.

Founded in

1973

Faculties – "The academic departments"

- History, Philosophy and Judaic Studies
- Literature, Language and the Arts
- Education and Psychology
- Management and Economics
- Sociology, Political Science and Communication
- Mathematics and Computer Science
- Natural Sciences
- The English Unit

Number of students

According to Wikipedia 39 000 as of 2006.

Technology Transfer Offices

OpMop Ltd.

Technion – Israel Institute of Technology (IIT)

General background

As Israel's oldest and premier institute of science and technology, the Technion - Israel Institute of Technology has been an active and leading participant in Israel's establishment and development. With supreme effort and unyielding dedication, deserts have bloomed, swamps have been transformed into fertile agricultural valleys, and sand has given way to silicon. Israel is now recognized as one of the world's most prominent high-tech innovators, and has been called the second Silicon Valley. The first two faculties were Civil Engineering and Architecture. Technion is the oldest still operating university in Israel as of today. Technion is committed to its role as the country's top

facility for science and technology, a role that is necessary for the future of Israel and to all of humanity[178].

Rank on Times Higher Education

Number 193

Founded in

1924

Faculties

- Aerospace Engineering
- Architecture and Town Planning
- Biology
- Biomedical Engineering
- Biotechnology and Food Engineering
- Chemical Engineering
- Chemistry
- Civil and Environmental Engineering
- Computer Science
- Education in Technology and Science
- Electrical Engineering
- Humanities and Arts
- Industrial Engineering and Management
- Materials Science & Engineering
- Mathematics
- Mechanical Engineering
- Medicine
- Physics

Number of students

12 856[179]

[178] Technion, About, http://www1.technion.ac.il/en/about, 2012-10-17

Technology Transfer Offices

T3

Tel Aviv University

General background

Tel Aviv University (TAU) is Israel's largest and most comprehensive institution of higher learning. With over 30 000 students studying in nine faculties and over 125 schools and departments across the spectrum of sciences, humanities and the arts, TAU attracts the best minds from across Israel and the world.

Situated in Israel's cultural, financial and technological capital, TAU shares Tel Aviv's unshakable spirit of openness and innovation. Ranked 14th in the world in terms of scientific citations, and among the top 100 universities internationally, Tel Aviv University is also Israel's first choice for students, and its graduates are the most sought after by Israeli companies. Innovation is in our DNA - and intellectual chutzpah is our forte[180].

Rank on Times Higher Education

Number 158

Founded in

1953

Faculties

- Faculties
- Arts
- Engineering
- Exact Sciences
- Humanities
- Law
- Life Sciences

[179] Technion, About, http://www1.technion.ac.il/en/about, 2012-10-17
[180] Tel Aviv University, About, http://english.tau.ac.il/about_tau, 2012-10-17

- Management
- Medicine
- Social Sciences

Number of students

Over 30 000[181]

Technology Transfer Offices

Ramot

University of Haifa

General background

The campus of the University of Haifa spreads along a Carmel Mountain ridge southeast of the city of Haifa and is surrounded by the Carmel National Park. The University was established in 1963 under the joint auspices of the Hebrew University of Jerusalem and the Haifa Municipality. In 1972, it gained academic accreditation as a separate institution from the Council for Higher Education.

The University of Haifa is the most pluralistic institution of higher education in Israel: sons and daughters of both veteran cities and development towns, kibbutzim and moshavim, new immigrants, Jews, Arabs, and Druzes, IDF officers and security personnel—all sitting together on the bench of knowledge in an atmosphere of coexistence, tolerance, and mutual respect.

The University considers the link between academic excellence and social responsibility as its flagship, and service to the community as one of its important goals[182].

Rank on Times Higher Education

Not on the list.

Founded in

1963, gained academic accreditation in 1972.

---

[181] Tel Aviv University, About ,http://english.tau.ac.il/about_tau, 2012-10-17
[182] University of Haifa, http://www.haifa.ac.il/html/html_eng/welcome.html, 2012-10-17

Faculties

- Faculty of Education
- Faculty of Humanities
- Faculty of Law
- Faculty of Natural Sciences
- Faculty of Social Sciences
- Faculty of Social Welfare and Health Sciences
- Graduate School of Management

Number of students

Around 17 000 students

Technology Transfer Offices

Carmel-Haifa University Economic Corp. Ltd.

Weizmann institute[183]

General background

Weizmann Institute's roots stretch back to the Daniel Sieff Research Institute built in 1934. In 1949 Weizmann Institute was formally dedicated. The Weizmann Institute has five faculties – Mathematics and Computer Science, Physics, Chemistry, Biochemistry and Biology – and the faculties in turn are divided into 17 scientific departments. In addition, the Feinberg Graduate School, the Institute's university arm, trains research students pursuing graduate degrees.

Rank on Times Higher Education

Not on the list.

Founded in

1934

Faculties

[183] Weizmann Institute, http://www.weizmann.ac.il/, 2012-10-18

- Mathematics and Computer Science
- Physics
- Chemistry
- Biochemistry
- Biology

Number of students

2 500

Technology Transfer Offices

Yeda Research and Development Ltd.