EMBRACING THE FAILURE, SHARING THE RISK: LEARNING FROM ISRAEL'S START-UP ECO-SYSTEM

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KAPULER, Natalie

THESIS

Submitted to
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ABSTRACT

EMBRACING THE FAILURE, SHARING THE RISK:

LEARNING FROM ISRAEL'S START-UP ECO-SYSTEM

By

Natalie Kapuler

Dedicated to Rochelle Jennings

ACKNOWLEDGMENTS

I feel immensely grateful and lucky to be supervised on this project by professor Hun-Joo Park. His mentorship and friendship have been a vital influence on me. I can only hope to repay some of his kindness in the future and make him proud.

This thesis is a result of almost four years of living, studying and working in South Korea. I would have never been able to do so without the support and encouragement of my parents, Yuri and Marina Kapuler in each and every aspect of my life, as-well as their boundless and inappropriate humor. Going out and exploring the world is as possible as your support system at home is strong, so my many thanks also go out to Libi Ostrovsky and Alex Iser for their friendship, argumentative, but ultimately forgiving, nature and well-timed photoshop skills. My many thanks are also to the Korean Government Scholarship Program that provided me with this opportunity and the staff at Korean Development Institute School of Public Policy who work tirelessly to make our stay and study in Korea as productive as possible.

I deeply believe in the social and political impact of technology innovation. It seems fitting somehow, that while writing on this same topic, I was assisted by a group of virtual strangers from all corners of the globe. Whether by inspiring, focusing, soothing, distracting, gif-ing, supporting or simply enriching my vocabulary, my friendship with Rochelle Jennings and is a living proof of how loose of a term “community” can be, and how far it evolved while remaining as vital as ever.

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LIST OF TABLES / LIST OF SYMBOLS OR ABBREVIATIONS

FDI: Foreign direct investment

GDP: Gross domestic product

MNEs: Multinational enterprises

OCS: The Office of the Chief Scientist

R&D: Research and development

STI: Science, technology and innovation

S&T: Science and technology

STEM: Science, technology, engineering and mathematics

VC: Venture capital

I. INTRODUCTION

The history of modern Israel is plagued by inner and outer instability in the increasingly volatile Middle East region. In 65 years of existence, Israel has taken part in 8 wars, which have put an immense burden on its economy. It also lacks natural resources and has a hostile climate for agriculture. Contrary to expectations, this tiny country of 8 million people has the 22nd largest economy in the world, with $235 billion. One of the main reasons for this is that Israel has the world's largest number of high tech start-up companies in proportion to its population, and attracts more venture capital investments per capita than any other country.

Israel boasts the highest density of start-ups in the world. There are a total of 3,850 start-ups, one for every 1,844 Israelis. More Israeli companies are listed on the NASDAQ exchange than all the companies from the entire European continent.[1] The number of Israeli companies traded on the largest stock exchange in the world, New York Stock Exchange, ranks third, behind only the United States and China.[2] In recent years, Israel has become a global exporter of ideas, innovation and technology.

Worldwide, start-ups tend to develop in clusters. Clusters differ significantly between countries and even between different regions in a country.[3] However, due to Israel's small territory (about the size of Silicon Valley), all of it is considered one *eco-system*, with high concentration of small to medium sized firms in different stages of development, and large complimentary services industry such as patent law firms and high-tech HR recruitment specialists. Concentrating on start-up

[1] Dan Senor and Saul Singer, *Start-Up Nation: the Story of Israel's Economic Miracle*, International Edition ed. (New York: Twelve, 2009), 13.
[2] David Ogul, "Israel: A Perfect Example," *San Diego Jewish Journal*, December 2012 (accessed April 18, 2014), http://sdjewishjournal.com/site/4570/israel-a-perfect-example/
[3] Thomas Gries and Wim Naude, "Entrepreneurship and Regional Economic Growth: Towards a General Theory of Start-ups," *Innovation: The European Journal Of Social Science Research* 22, no. 3 (2009): 310.

eco-systems in which large numbers of start-ups seem to develop, both mitigates the issue of the dynamic nature of start-ups, and allows focus on the factors that facilitate the emergence of these clusters.

This research will attempt to answer what factors have made Israel a successful incubator for start-up businesses.[4] The first part of the literature review attempts to sketch a theoretical framework for research of start-ups. Most of the research into start-ups is relatively recent, and lacks a systematic approach, even more so in the case of Israel. There is no single theory that defines the start-up structure and the difference between start-up cultures in various countries[5]. Start-ups vary dramatically in size, ambition, culture, and life expectancy as they quickly evolve, or quickly flame out, related to the high paced evolution of the technology in which they specialize. However, despite the unpredictability of the process, there is a great interest in the right "recipe" for developing a good start-up environment. The select literature about success and failure of other start-up environments around the world would complement the Israeli case study.

As natural resources dwindle worldwide, the task of allocating country assets effectively becomes a vital concern. Developing countries strive to maximize growth within their particular restricted conditions. Using human capital effectively, despite instability or the lack of natural resources, may help address this greater problem. Studying and binding together the successful development patterns in seemingly different case studies would help build wider, more comprehensive models for other countries.

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[4] In this research, "Start-up" is used as the generally accepted term for a small, private enterprise of high-tech technology.

[5] Franz Todtling and Herta Wanzenbock, "Regional Differences in Structural Characteristics of Start-ups," *Entrepreneurship & Regional Development* 15, no. 4 (2003): 351.

II. LITERATURE REVIEW

A. World and Theoretical Perspective

Innovation clusters are "places with dense webs of interconnected technology companies, customers, and suppliers."[6] The biggest, and most successful, start-up clusters in the world are Silicon Valley, Beijing, Bangalore (India), Boston and Israel.[7] Much research was devoted to the success of those clusters, Silicon Valley in particular, and the attempts of establishing new ones, usually unsuccessfully.

According to MIT, factors such as liberal immigration and venture capital laws improve the chances of a cluster to flourish. Proximity to higher education is also an advantage; Boston has more than 85 universities and Beijing more than 70.[8] Silicon Valley success was also attributed to close proximity to major research universities – Stanford and University of California, as noted by many scholars.[9]

O'Mara claims that Silicon Valley is hard to duplicate, due to it being a product of Cold War political economy, "distinctively American, rooted in particularly American systems of governance, market structures and educational institutions."[10] O'Mara notes that pre-Cold War the comfortable weather and business culture, as well as proximity to universities, had supported a vibrant scientific community in the Valley. However, it lacked the necessary capital to transform it to start-up cluster that it became later. That capital was provided thanks to new demand for strengthened

[6] "World Innovation Clusters." Technology Review 116, no. 5 (September 2013): 90
[7] Methodlogy of determining the biggest clusters differ in the literature, some research look at the size of venture capital, some on the amount of firms, or the amount of workers. Those five clusters are usually featured in all methodologies.
[8] Ibid., 90.
[9] O'Mara, Margaret Pugh. 2006. "Cold War politics and scientific communities: the case of Silicon Valley." Interdisciplinary Science Reviews 31, no. 2: 121.
[10] Ibid., 122.

military defense that caused an unprecedented increase in public investment in science.

Numerous studies claim Silicon Valley is hard to impossible to duplicate. Several different reasons are given. While O'Mara focused on *Cold War funding*, Anna Lee Saxenian in her seminal book *Regional advantage: culture and competition in Silicon Valley and Route 128* is focused on professional ***networks*** and easy information exchange. She notes that the firms in Silicon Valley competed and cooperated at the same time. Research by Wadhava agrees with that thesis and notes the cooperation between science and engineering departments in academia, with strong links to local firms, "all focusing research on the needs of industry, creating culture of cooperation and information exchange."[11] He also points out another factor that has drawn much positive attention to the success of the Valley – the high percentage of ***diversity***, which is according to many, is a necessary part of successful innovation. According to Wadhava, "from 1995 to 2005, 52% of Silicon Valley start-ups had one or more people born outside the U.S. as founders, twice the rate in the U.S. as a whole."[12] In another study by Saxenian "there were 2,001 Chinese CEOs and 774 Indian CEOs heading Silicon Valley companies in 1998. Together, they employed 58,282 people and accounted for 17% of sales ($16 billion) and 24% of the Valley's high-tech firms."[13]

Etzkowitz and Dzisah also focus on the necessity of informal exchange of ideas for successful start-up eco-system. By meticulously comparing Silicon Valley to another of the five largest start-up clusters, Boston, the authors determined that

[11] Wadhwa, Vivek. "Silicon Valley Can't Be Copied." Technology Review 116, no. 5 (September 2013): 87.
[12] Ibid., 88.
[13] Saxenian, Anna Lee , *Silicon Valley's New Immigrant Entrepreneurs*,report to the Public Policy Institute of California, June1999.

regional cooperation, and specifically "(an) effective triple helix of university – industry – government interactions"[14] are necessary, and need to be facilitated by ***informal networks***. Additionally, Etzkowitz and Dzisah echo O'Mara's idea of the importance of federal government as "early costumer". However they draw the opposite conclusion; by expanding the scope of the research to include another successful start-up cluster, albeit one that developed at a different time and pace from Silicon Valley, Etzkowitz and Dzisah concluded that Silicon Valley can indeed be duplicated.[15]

For the purpose of stronger inner logic of the research, I also examined the literature about the less successful innovation clusters. A fascinating econometrics research by Rodrigez-Pose has tested 152 small innovation clusters in Europe. The author made a choice I admired greatly with "looking not just at the brightest trees in the forest (…) but also at the average and even the moribund trees—that is, the clusters that happen to be located perhaps in the wrong environments, the wrong sectors, and with inadequate management and policies."[16] The study's conclusion corresponded with Silicon Valley, Boston and Beijing case studies – proximity to ***education centers*** has a major influence on success of innovation clusters.[17] Another article by Leung also focuses on a high-tech cluster that hasn't been successful – Singapore. One of the main reasons of failure is the lack of diversity in the workforce, which is a result of suspicion and resentment of the foreign talent.[18] The importance of immigrant workforce is also the main idea in another article about the failure of

[14] Etzkowitz, Henry, and James Dzisah. 2008. "Unity and Diversity in High-tech Growth and Renewal: Learning from Boston and Silicon Valley." European Planning Studies 16, no. 8: 1022.
[15] Ibid., 123.
[16] Rodríguez-Pose, Andrés, and Fabrice Comptour. 2012. "Do Clusters Generate Greater Innovation and Growth? An Analysis of European Regions*." Professional Geographer 64, no. 2: 227
[17] Ibid., 227.
[18] Leong, Bernard. 2006. "Finding the Golden Path: Can Singapore be a Silicon Valley? (Cover story)." Innovation, October. 63.

Singapore cluster by Leng Tan,[19] and another about the success of Silicone Valley by George Koo.[20] Chandra Malairaja examined the establishing process of the Malaysian Cluster. Malaysia has the benefit of learning from other countries experienced in establishing new clusters. For example, networking development is required not only between firms, but also between the university, industry and the government. While as O'Mara, Etzkowitz and Dzisah have shown, this interaction developed in Silicon Valley organically due to Cold War necessity. In the case of Malaysia, "the role of the government in capacity building is expected to bridge the gap between university research and its industrial application. (…) This partnership could also be extended to address various other issues affecting the region, such as labor and immigration matters, quality of education, infrastructure requirements, research grants and funding, tax policies, etc.[21]

At the first glance, it seems the literature about start-ups goes in several disconnected directions at once. But it has one thing it is mostly in agreement about – a number of factors made it possible for the Silicon Valley to emerge as a successful case of innovation cluster. While the factors and their relative influence are being argued about, most writers don't look at the actual monetary investment in the Silicon Valley, but the demographical and sociological factors that allowed it to flourish. Many of the new Silicone Valley "clones" has received substantial government investments. It seems that the scholars agree that the most influential factors are not institution based, but are informal, and harder to define, factors such as the dynamism and entrepreneurial spirit of the companies, the way business is conducted in terms of risk taking; the willingness to accept failures, the ability to network and collaborate

[19] Lay Leng, Tan. "Transplanting the Silicon Valley Experience to Singapore. (Cover story)." Innovation 6, no. 3 (October 2006): 39.
[20] Koo, George. 2006. "Silicon Valley's Success Built by Immigrants." Chinese American Forum 21, no. 4: 38.
[21] Chandra Malairaja, "Learning from the Silicon Valley and Implications for Technological Leapfrogging." International Journal Of Technology Management & Sustainable Development 2, no. 2 (June 2003): 89.

with your competition and the diversity of background and ideas – all have in common the fact they are informal, and have more in common with the business culture, than business institutions.

B. Israeli Case Study Literature

The research into Israel's start-up cluster is relatively recent, and so far rather limited. One of the seminal works in the field, *Start-Up Nation: the Story of Israel's Economic Miracle,* was published just in 2009. The book relies on precise economic data from sources as diverse as NASDAQ, World Economy Forum, Israel Venture Capital Research Central, Central Bureau of Statistics (Israel), United Nations Development Programme and the CIA.[22] The research is complimented by hundreds of interviews with business insiders in the international innovation community as well as Israeli start-ups. The book's research is comprehensive and its reputation well deserved. It is, however, focused heavily on demographical, historical and geopolitical factors that can be viewed as unique to Israel.

First, Israel's diversity brings together people of different backgrounds and experiences to foster a wealth of new ideas and solutions. Though thought of as a Jewish State, Israel has seventy different nationalities living within its borders. The second key element pointed out by the research is Israel's military and defense industry and its influence in "encouraging problem solving and leadership optimization."[23] The Israel Defense Forces (IDF) is integrated into Israeli society with a high degree of reciprocity. Most Israeli citizens are drafted, serve for a minimum of two to three years, and then remain part of the reserve forces as they move on in their

[22] Senor and Singer, *Start-up Nation,* 332-361.
[23] Ibid., 71.

respective careers. One's unit and position in the military is an important factor for employers in Israel, with many companies targeting for recruitment graduates of specific military programs. Thirdly, the authors focus on the way Israel's "adversity, like necessity, breeds inventiveness."[24]

Separately, a variety of scholars focused on these factors in more depth. In particular, the heterogeneous demographic has attracted much attention. According to Winters (2009), Israel has immigrants from more than 140 countries.[25] In addition to diversity of nationalities, different interpretations of what it means to be Jewish, wide disparities in religious observance and secularism, and various sub-cultural differences remain. The scale of religious observance is as varied as secular, Orthodox, and ultra-Orthodox Jews. Within the nationalities, the largest division is between Russian immigrants (mostly secular), native-born Israelis, Ethiopian, Sephardim (Jews from North African or Middle East Muslim countries), and Ashkenazim (Jews from Eastern Europe). Additionally, Muslim and Christian Arabs, Druze, and other smaller ethnic and religious groups are present.[26]

Despite the sharp differences, in a study of secular/religious and Jewish/Arab fully integrated schools, Winters found that "Classes with diverse populations help create a living, dynamic laboratory for understanding multicultural approaches, personal growth, and modeling future work".[27]

Several researchers focused on civilian-military relations in Israel. Israel is the only democracy in which the military has occupied a central place for such a long period. While it has taken a dominant place in other societies, for example

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[24] Ibid., 16.
[25] Jeffrey Winter, "Preparing Teachers to Work with Diversity Issues in Israel: Paradigms, Puzzles, and Praxis," *Multicultural Perspectives* 11, no. 1(2009): 38.
[26] Ibid., 38.
[27] Ibid., 40.

Britain or the United States during World War II, it has done so in Israel for a much lengthier period of time.[28]

Barak and Sheffer (2010), examine the formal and informal connections and the dynamic, prolonged mutual influence of civilian and security sectors in the cultural sphere, political system, society, the economy, and the public discourse.[29] The authors reject the traditional theory of civilian-military relations as two separate systems, each trying to assume control of the other.[30] Barak and Sheffer note that this paradigm imbued with Western ethnocentrism, not applicable to Israel,[31] and that the informal exchanges, which concern various patterns of public policymaking and behavior, are by no means random and haphazard but are routinized and have assumed a continuous nature.[32] Unlike the traditional approach of viewing the military and the civilian sectors as homogenous, autonomous and completely separate, the authors view these sectors as consisting of many actors that intermingle closely, and form a highly informal policy network – the Security Network.[33] Due to mandatory military service, the increased penetration of active and retired personnel of the security sector into most of the civilian spheres, results in penetration of military values and influences of most civilian sectors.

Despite the relatively recent publication of the *Start-Up Nation* book in 2009, the world of high-tech innovation is high paced and there are already several articles elaborating on several themes from the book and supplementing its economic data. In 2010, Senor and Saul Singer wrote the follow-up article "What Next for the

[28] Edna Lomsky-Feder and Eyal Ben-Ari, *The Military and Militarism in Israeli Society* (Albany: State University of New York Press, 1999), 4.
[29] Oren Barak and Gabriel Sheffer, *Militarism and Israeli Society* (Bloomington, IN: Indiana University Press, 2010), 1.
[30] Ibid., 17.
[31] Ibid., 19.
[32] Ibid., 21.
[33] Ibid., 26.

Start-Up Nation?" refining the connection between military and civilian complex in Israel. The authors maintain that while it is often assumed that the most important connection between the military and high-tech industry occurs when military innovations are given civilian applications (the internet, for example), "the connection is broader and deeper than that. The military contribution to the tech scene is cultural as much as, or more than it is technological. Young Israelis who achieve junior officer rank (…) are taught leadership and teamwork skills in an intensive way, regardless of their direct exposure to technology. They learn that completing missions often requires improvisation and innovation".[34]

Vamseedhar (2007), elaborates on technologies that were initially developed for military purposes, but were later developed in the civilian sector by graduates from elite programming units in the military. Electro optics and Internet firewalls, originally created to meet security needs, proved highly exportable and later were developed and perfected for worldwide use by a leading Israeli company, Check Point Software Technologies. Check Point is one of the first generation of Israeli start-ups. It exemplifies the quick transformation the Israeli economy went through in the 1990s. It was established in 1993 by three graduates of "Unit 8200", an Israeli Intelligence Corps unit responsible for collecting signal intelligence. The three founders developed the core civilian technology of Check Point, based on their work in 8200. By 1996, Check Point was the leading expert in firewall technology in the world, has developed one of the first VPN networks, and now its revenue is estimated as 1.2 billion USD.[35]

[34] Dan Senor and Saul Singer, "What Next for the Start-Up Nation?" *The Wilson Quarterly* 34, no. 3 (2010): 65.
[35] Vamseedhar, *Israel : Technology Prowess and Entrepreneurial Dilemmas*, 4.

Vamseedhar's main focus is on government involvement in technology industry. The author claims that two major initiatives in the early 1990s, in venture capital and in research, have contributed to the formation of the military-industrial-civilian network. The "Yozma" initiative was founded in 1993 to create a start-up network, and Office of the Chief Scientist (OCS) formed the national incubator project. The incubator project invested in start-ups who were refused funds by private sector. The project sought to take ideas or lab projects and turn them into companies through relatively modest grants of $200,000 to $400,000 annually over a 2-year period.[36]

Another influential researcher in the field is Professor Gil Avnimelech. Avnimelech has co-written more than 65 studies about entrepreneurship in general and Israeli start-up eco system in particular. Unlike other seminal work in the field, Avnimelech is focused on institutional structures and governmental policies that contributed to the development of the eco-system. Avnimelech sees the venture capital investment as a necessary part of the start-up eco system, and for the purpose of creating a successful eco-system, one of the roles of the government is to encourage domestic and foreign venture capital investments, to facilitate, and to create favorable conditions for them in the cluster's/nation's economy.

His article "*Evolutionary interpretation of venture capital policy in Israel, Germany, UK and Scotland"* divides the evolutionary process in Israel to three stages: background conditions (1969–1984), pre-emergence (1985–1992) and emergence (1993–2000).[37] According to the writers, "by the late 1960s a significant science, technology and higher education infrastructure had been

[36] Ibid., 5.
[37] Avnimelech, Gil, Alessandro Rosiello, and Morris Teubal. "Evolutionary interpretation of venture capital policy in Israel, Germany, UK and Scotland." Science & Public Policy (SPP) 37, no. 2 (March 2010): 103.

established, a process which had started in 1925". The Office of the Chief Scientist (OCS) at the Ministry of Industry and Trade was established in 1969 to explore and built on those favorable conditions. During the "background conditions" phase, after the establishment of OCS, three new universities and a number of research institutes were established and innovation policy was initiated with the OCS's grants to research and development in private firms, as-well as to firms cooperating with US firms.[38] In second, "pre-emergence" phase, the OCS shifted focus to establishment of domestic venture capital market.[39] In those years, suitable configurations of start-up and venture capital firms were selected for further investment by government program "Yozma", as was discussed by Vamseedhar above. It is also important to note that this phase coincided with global changes such as liberalization of communication markets in USA, Japan and UK that positively affected the Silicon Valley start-ups. It also became increasingly easier for foreign start-ups to float in NASDAQ. The successful implementation of the "Yozma" Program has triggered the "emergence phase" in 1993. As a result, the number of start-ups increased from 300 to approximately 3,000 with the total capital invested approximating 10 billion USD by 2000.[40]

These ideas and phases are further developed in his 2008 research *"A Five-phase Entrepreneurial Oriented Innovation and Technology Policy Profile: The Israeli Experience.* In it, he recommends the phased innovation policy process that Israel went through as a model that other countries looking to develop their clusters can learn from, though cautions somewhat paradoxically that "Israel has a very peculiar innovation system and a specific development path, which cannot be taken as an example for other countries and regions. Therefore, this experience cannot be

[38] Ibid., 103.
[39] Ibid., 104
[40] Ibid., 104.

repeated precisely in other countries."[41] The aspects that makes Israeli experience "peculiar" to Avnimelech, are "strong academic base and very high quality human capital, a very strongly developed military R&D industrial complex, entrepreneurial culture, strong relations with human capital and academic institutions in other countries, strong relations with the US technological and capital markets, and government coherent innovation strategies."[42] Thus, even Avnimelech, the strongest quantitative researcher focused mainly on institution contributions to Israeli start-ups eco-system, eventually results to a culture-based caveat in his explanation.

[41] Avnimelech, Gil. "A Five-phase Entrepreneurial Oriented Innovation and Technology Policy Profile: The Israeli Experience." European Planning Studies 16, no. 1 (January 2008): 94.

[42] Avnimelech, Gil. "A Five-phase Entrepreneurial Oriented Innovation and Technology Policy Profile: The Israeli Experience." European Planning Studies 16, no. 1 (January 2008): 97.

C. *Comparing Israeli and World-wide Literature*

While the scholars are in disagreement about the deciding factors to a success of a start-up cluster, the world and Israel-case literature seemed to agree on one key requisite: in order to flourish, a start-up cluster must be an *eco-system*. It has to have more than a collection of start-up firms, it has to have the right institutions, but more importantly, it has to have a complex network of informal interactions.

The scholars are divided on the factor that has the biggest influence on the eco-system. Certainly, the phenomenal success of Silicon Valley had led to much thought to whether it can be duplicated. Even the actual architecture of the valley has been studied in depth. Several factors have been agreed on though, even if their relative importance has not. First, access to education institutions is important. Second, the cooperation of research education institutes and industry, and between the different firms within the industry is important. The cooperation and communication is facilitated by the third factor, informal networks. The nature and quality of the human capital is also necessary, with diversity a vital forth factor. Countries and States with liberal immigration policy, comfortable climate, and corporate culture that encourages hopping from firm to firm allows firms the choice and the competition of the best minds available worldwide.

At the first glance, the case study of Israel satisfies all these conditions. As the studies of the education system by Winters and Menahem shown, not only is the start-up cluster diverse – the whole country is a dynamic melting pot of over seventy nationalities. Those are different enough to bring diversity of ideas to every project, but unified enough through the mandatory military service to prevent those differences to become a major disadvantage. The army also provides the base for the

informal network, as exemplified by Barak and Sheffer's study, and provides the technological basis and education, as noted by Vamseedhar. Israel also has the largest percentage of engineers in OECD countries, thanks in part to the importance of education in the Jewish tradition, and in part thanks to an immigration of highly skilled labor from the former USSR in the 90s.

However, both Israel-focused and Silicone Valley-focused scholars tend to point out the uniqueness of their development process. As much as the research regarding Israel's development is well meaning and extensive, at times it exhibits the same shortcomings the literature about the development of Korea, Japan, and Singapore sometimes exhibit. Their rapid growth, despite the scarcity of natural resources and slow restoration after Second World War, bewildered many. Frequently, development specialists develop an overly narrow, country-specific approach. As Gries and Naude note, most empirical studies on the determinants of start-up rates make use of regional data within a specific country, because comparisons between countries are often difficult due to non-comparable data and definitions. [43] Furthermore, the language that developed in literature surrounding Israel, Silicon Valley, Korea and others is a language of "miracle", of something that is impressive, due to the countries unique character. Praising these countries well deserved progress boosts the national pride, and invites further foreign investment. It does, however, limit the academic scope of the research, and constrains our ability to expand success to other countries.

[43] Thomas Gries and Wim Naude, "Entrepreneurship and Regional Economic Growth: Towards a General Theory of Start-ups," *Innovation: The European Journal Of Social Science Research* 22, no. 3 (2009): 309.

III. CASE STUDY - ISRAEL

Previous chapter established the factors vital to establishment of start-up eco-system such as government-industry-academia cooperation, diversity of population, education and informal networks. This section will showcase how these aspects are exhibited in the Israeli case study.

Academia-Government-Industry cooperation

The government policies were vital in creating the knowledge economy. All science and technology policies and budgets are managed exclusively through OCS – Office of Chief Scientist, under the Ministry of Economy. Established in the early 70s, the OCS had several policies specifically targeting increase of cooperation between underdeveloped sectors of the economy. At the first stage, the OCS kick-started the venture capital industry. "Yozma" program was created as a government VC fund of $100 million that had two functions. The first was to invest $8 million in 10 private venture funds, which would be 40% or less of the total capital— the rest was provided by other private limited partners. To get this financing, the funds' managers had to secure investment and partnership from at least one local and one established foreign financial institution. Thus the OCS encouraged the involvement of the local private sector, as-well as international cooperation.

At this stage it will helpful to explain in short the main revenues in which OCS operates. OCS activity targets innovation in all stages of its development: "**pre-seed and seed programs"**, "**Incubators programs"**, "**Pre-Competitive and Long-Term R&D Programs", "International programs"** and the **"National R&D Fund".**

"**Pre-seed and seed programs"** support the wide range of activities required of entrepreneurs who are taking their *first steps* towards developing a new technological initiative before industrial production becomes feasible. The **"Incubators"** encourage technological innovation by creating a system that will provide entrepreneurs with a comfortable and convenient incubator in which they can conduct the research, development and organization that is necessary for *transforming a technology-based idea into a commercial product.* "**Pre-Competitive and Long-Term R&D Programs"** Support generic R&D that is still *far from practical implementation* in the market and *forming bonds between the academia and the industry* that will ultimately produce products based on advanced knowledge and technology. **"National R&D Fund Programs"** –help *budding and mature companies* develop processes of converting theoretic knowledge into a *functional product*. And the "**International programs"** help Israeli companies form strategic links with companies abroad in order to develop their competitive capabilities and their ability to penetrate international markets.

When establishing VC and FDI industries was deemed vital, the OCS has made sure the necessary knowledge and stimulants would flow through all areas of its activity. The "Yozma" program demanded from the companies in need of governmental assistance to involve private sector, was under the "National R&D Fund Programs" umbrella that targeted "mature" companies. However, meeting the goal of strengthening private sector involvement was not left to mere chance and to the mature companies only; pre-seed and seed programs that assist individual inventors, young entrepreneurs and even students, started to include business education. Inventors in the earliest stages of their innovation projects were provided with not only the funds and necessary technological know-how to help the project to mature,

but knowledge such as evaluation of the technological and commercial potential of a project, filing for a patent, building a prototype, drafting a business plan and initial business development. [44]

The goal of the second revenue of OCS activity – "Incubators" is to transform innovative technological ideas in their early, high-risk stages into viable startup companies capable of raising money and operating on their own. [45] In regard start-up companies themselves, they continue receiving mentorship from industry leaders from the private sector in their field. However, the incubators are a vital contributor to the private sector-government cooperation since they strongly encourage private sector involvement through the principle of "***risk sharing***": in the first two years, most of the risk is taken by the government. An incubator licensee can invest only 15% of the approved budget of any new project, with the government providing the rest. All incubator programs are run as grants that are repayable to the OCS on successful completion of the project only upon generation of sales, in the form of a percentage of the revenues annually.[46] While the Incubator licensee invests only 15% of the project, they receive up to 50% of the shares.[47] This encourages the active participation of the private sector.[48]

Since 1991 and to the end of 2012, the government initiated over 1,700 companies with a total cumulative government investment of over 650 Million Dollars. Over 1,500 companies had matured and left the incubators. Of these graduates, 60% have successfully attracted private investments. By the end of 2012, ~40% of the incubators graduates are still up and running. The total cumulative

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[44] ***(http://www.economy.gov.il/Publications/Publications/DocLib/RnD_IncentivePrograms_English.pdf)***
[45] Chief Scientis Office, *Incubators*, Accessed July 7, 2015.***http://www.incubators.org.il/article.aspx?id=1703***
[46] Chief Scientis Office, *Incubators*, Accessed July 7, 2015.***http://www.incubators.org.il/article.aspx?id=1703***
[47] Chief Scientis Office, *Incubators*, Accessed July 7, 2015.***http://www.incubators.org.il/article.aspx?id=1703***
[48] Chief Scientis Office, *Incubators*, Accessed July 7, 2015. ***http://www.incubators.org.il/article.aspx?id=1703***

private investment in graduated incubator companies reached over 3.5 Billion Dollars. ***This means that on every Dollar the government invested in an incubator company, the company raised an additional 5 – 6 Dollars from the private sector.***

The OECD classifies Israel's science and technology policy as "bottom-up approach". [49]. The R&D in Israel has been a national priority from the mid-80s, but while the ***importance*** of investment in science and technology remains a national priority, the implementation is done through policies that target ***specific areas***.

Having achieved the level of cooperation with the private sector, locally and abroad, that caused the innovation eco-system to thrive, the "Yozma" program was discontinued (Some principles of it still exist in other OCS programs, mostly those which target international cooperation). The OCS has turned its attention to the third aspect of the triple helix: cooperation between the government, industry and the academia.

Academia participation in the start-up eco-system is harder to measure, and since it involves frequently far into the future, "blue skies" innovation, it is a field that is all too easy to neglect, focusing on existing science and technologies that can be developed and exploited for revenue faster. However, focusing on existing technologies makes the country, or a company, more vulnerable to global economic and technological trends and crises. Investing in future, yet un-exploitable technology, provided Israel with greater flexibility in changing markets.

To achieve better cooperation with academia, OCS employs several dozen programs under the "Pre-Competitive and Long-Term R&D Programs". Those

[49] *http://libproxy.kdischool.ac.kr/b0d1677/_Lib_Proxy_Url/www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-industry-outlook-2014_sti_outlook-2014-en*

programs support generic R&D that is still far from practical implementation in the market and forming bonds between the academia and the industry that will ultimately produce products based on advanced knowledge and technology. If the incubator programs illustrate best the principle of risk sharing, the "pre-competitive and long term R&D programs illustrate well the role Israeli government plays in bridging the gap between the academia and private sector, as-well as growing attention to specification that is the trend in the last decade or so. The pre-competitive programs (which exist under the name "Magnet programs" under the OCS) target niche research that is in need of development. A wide variety of fields is supported, however they are adjusted slightly every few years, to include new types of fringe research, or to invest in a field that the OCS deems ripe to be promoted in the mainstream research or private sector. For an example of the latter, bio-tech and genome research were considered not necessarily beneficial economically for many years, but were supported under general programs of the "Pre-Competitive and Long-Term R&D Programs" umbrella. Recently they were promoted specifically by the Israeli government as it becomes possible that they will be profitable in the next few years.

At the time of composition of this research, Magnet had several specific programs: for example, "NOFAR" provides support and funding in the field of biotechnology, nanotechnology and development of medical equipment. "MEIMAD" supports R&D technologies that can have both military and civilian use (media streaming, for example, encoding, cyber security, etc). "TSATAM" gives grants for research in Biomedical engineering, biotech, human genome etc. those fields are selected because the research in them is long-term, and while it provides long term benefit for the science field on the whole, the research is far from practical implementation and therefore is not likely to attract investment from private sector.

Likewise, “KAMIN” grants are given to researches in universities to encourage production of functional research in the future (mid process grant) “MAGNETON” – grants for technology transfer between academia and commercial companies. So, “MAGNETON” targets scientific research after the phase in which “KAMIN” assists.

In conclusion, the government sees its main task as bridging the gap between academia and the private sector. It achieves that task through numerous activities and programs, stimulating both the inventors, companies at all stages of development, private sector and academics. The main tool of the Israeli government is the principle of ***“risk sharing”***. It absorbs most of the loses in unsuccessful investments, but allows the private sector to take equal parts of profit, and it invests in projects, such as in ““Pre-Competitive and Long-Term R&D Programs” that are guarantee no profit in the near future, in the hopes it will benefit all, academia and private sector alike, in the remote, obscure future.

Human capital: Diversity and Education

As immigrant country, Israel has been naturally diverse from the day it was established with immigrants from 140 countries living within its borders. The diversity in population grew even further in the early 1990s. Beginning in 1989, Israel absorbed a wave of immigration from the former Soviet Union that resulted in a 20% increase in population by the mid-1990s. Due to demographic characteristics of the Soviet immigrants, the number of young people between ages 20-24 eligible for higher education in Israel, grew by 42%.[50] The education system responded well to the growing demand. By 2000, institutional capacity began to exceed the number of applicants[51], showing great adaptability. By 2007, research showed that about 28% of Israel's population has university degrees and 1.35% of them are engineers or scientists, more than in any other OECD nation.[52]

The brain drain/gain/circulation approach provides an additional perspective on the issue. The prevailing approach to a high value workforce leaving the home country for better opportunities (usually) in favor of the West, has regarded this phenomenon as "brain drain" – a loss to the home country. AnnaLee Saxenian is one of the seminal researchers on the subject of Silicone Valley and one of the scholars that popularized the term "brain circulation" as an alternative perspective. [53] According to her, the foreign born engineers and scientists in Silicon Valley have created social and professional networks to mobilize the information and the capital to start technology firms. More importantly, those communities provide links to entrepreneurs at home, building transnational communities of knowledge. They also

[50] Gila Menahem, "The Transformation of Higher Education in Israel Since the 1990s: The Role of Ideas and Policy Paradigms," *Governance* 21, no. 4 (2008): 510.
[51] Ibid., 514.
[52] Paidipati Vamseedhar, *Israel: Technology Prowess and Entrepreneurial Dilemmas* (India: IBSCDC, 2007): 8.
[53] Saxenian, AnnaLee. "BRAIN CIRCULATION. How high-skill immigration makes everyone better off." *Brookings Review* 20, no. 1 (2002): 28-31.

connect between US-based firms and companies at home, and assist the homeland companies with recruitment of capital and talent in the home-countries.

The challenge of brain drain is recognized in Israel. With very high percentages of population with advanced degrees, in a relatively small economy, there is a perception of a "glass ceiling" within Israel's entrepreneurship community. Israel has 6,602 researchers in R&D per million people, only slightly more than Korea's 5,928.[54] But with Israel's 8 million population, and only 8 universities which perform research, the notion that in order to really succeed, you need to leave the country, is prevalent.

Israel approached the problem of "brain drain" somewhat counter-intuitively, but in a way I argue has been more efficient long-term. First, it did not invest resources to luring the professionals back, but established deeper connection with its scientific community abroad. And second, it counter-balanced the loss of it human capital, by establishing large network of bilateral R&D co-operation abroad.

[54] "Researchers in R&D (per Million People)." World Bank. Accessed May 29, 2015. http://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS.

Informal networks, culture and multinationals

It is important to note, that all factors influencing the development, or failure to do so, discussed in the paper so far, are institutional. The triple helix of government-education-private sector are all formal institutions, but the cooperation and communication between them is often through informal channels such as the security network in Israel, or through ethnic professional associations in Silicon Valley. There is another factor that contributed to Israeli innovation eco-system that seems to be the result of both formal, institutional actions, and favorable cultural perceptions – the presence of multinational corporations. Attracted to Israel by the favorable governmental practices such as tax breaks and abundant of human capital, those companies flourished in Israel due to lack of negative connotations, or "us vs them" mentality, which is an informal aspect.

As recently as 2013, there was much excitement in Korea about US based GE (General Electric) announcing establishment of its subsidiary in Korea. There were also rumors of Siemens, a global leader in electric engineering, using Korea as its base of operations in the Asia Pacific region.[55] The Multinational firms are allowed, even encouraged to invest in Korea, but the success of the local conglomerates have provided an uphill battle.

In contrast, GE been present in Israel since 1950, currently operating 8 R&D centers.[56] Siemens has been investing in Israel's innovation eco-system since the 90s, its success leading it to establish Siemens Israel subsidiary in 2000. To date,

[55] Cho, Mu-hyun. "Multinational Firms Flocking to Korea." Koreatimes. May 2, 2013. Accessed May 22, 2015.
[56] "Multinationals - GE." Invest in Israel (Israeli Ministry of Economy). June 8, 2012. Accessed May 22, 2015. http://www.investinisrael.gov.il/NR/exeres/CEB4D0F6-1AC0-455A-9875-42D5D1A56548.htm

Siemens has invested $150 million in Israeli start-ups and venture capital funds.[57]

The multinational companies in Israel have a mixed strategy within the eco-system: they seek out and purchase the start-ups with the technology solutions that they need, preferring absorbing whole companies if needed, rather than developing the new technology in-house. But the multinationals also actively engage with the eco-system, developing it and the human capital further, as well as with each other. For example, Intel Israel is one of the most important subsidiaries of Intel. The Sandy Bridge chip developed by Intel Israel accounts for 40% of Global Intel Corporation's notebook processors revenue.[58] It absorbed the local firms specializing in different technologies it deemed necessary to its expansion - Neocleus, experts in PC virtualization, Telmap, an Israeli-based navigation software company and Idesia, specialists in computer security. On the other hand, Intel also participated in 64 as a passive investor - reaping the benefits if the company was successful, and absorbing the loss if it was not. Most interestingly, Intel and GE Healthcare set up a joint technology evaluation laboratory in Israel. The new lab is located close to both headquarters facilities and the managers and employees from both companies work together to optimize their products, such as Intel's microprocessors and GE Healthcare's ultrasound diagnostic imaging systems.[59]

Miscrosoft Israel has followed a similar strategy within the Israeli eco-system. Relying on local talent it developed several technologies vital to its global activities – Microsoft gateway VPN technology; Microsoft Security Essentials anti-virus suite, the recommendation system for Xbox systems and others. Microsoft also

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[57] "Multinationals - Siemens." Invest in Israel (Israeli Ministry of Economy). June 8, 2012. Accessed May 22, 2015. http://www.investinisrael.gov.il/NR/exeres/CEB4D0F6-1AC0-455A-9875-42D5D1A56548.htm

[58] "Multinationals - Intel." Invest in Israel (Israeli Ministry of Economy). June 8, 2012. Accessed May 22, 2015. http://www.investinisrael.gov.il/NR/exeres/CEB4D0F6-1AC0-455A-9875-42D5D1A56548.htm

[59] Ibid.

absorbed companies with narrow specialization such as Peach's "enhanced TV services for digital television", Gteko, a provider of automated technical support for personal computers, Secured Dimensions, with its technology for the protection of applications and others.[60] Miscrosoft further engaged with the innovation system by establishing a Microsoft accelerator, which provided start-up to companies regardless of their future profitability, legal aid, free office space, coaching, and mentorship from specialists in the technology, finance, investors and CEOs of other start-ups. Microsoft takes no equity stake in local start-ups, nor does it provide funding, focusing instead in improving communication between Microsoft and start-ups and between start-ups themselves.

Cisco, HP, SAP, Motorola and IBM all follow a similar three-pronged strategy. Cisco in particular has received great praise in Israel and worldwide for its efforts to connect the Israeli and Palestinian economies and peoples, through sponsored technological partnerships. Cisco also engages in several partnerships and initiatives to enhance technical capacity, connectivity, education, and opportunities for demographics in need such as women and youth in Israel, the West Bank and Gaza. In the last few years other multinationals established substantial subsidiaries in Israel – Apple, Google and so on.

It is important to note that even though these multinational companies compete with each other within the Israeli system and globally, they also cooperate with local start-up firms, communities and with each other, as elaborated in case of GE and Intel.

Favorable government policies and lack of pressure from local

[60] "Multinationals - Microsoft." Invest in Israel (Israeli Ministry of Economy). June 8, 2012. Accessed May 22, 2015. http://www.investinisrael.gov.il/NR/exeres/CEB4D0F6-1AC0-455A-9875-42D5D1A56548.htm

companies has contributed to these multinationals flourishing, but this is not an obvious development. The multinational companies are not perceived as foreign, alien, aggressive forces. They do not have the stigma of colonialism, despite Israel having a long colonial history, from ancient Babylon, in 7th century BC, to the British Mandate in the 20th century. These companies are trusted to be a part of the local system, as another tool that local start-ups can use for funding, or cooperation. In fact, Intel Israel has been voted most desired workplace in Israel since 2008, losing the first place only last year to Google Israel. In a traditional annual survey, yet again in 2015, 5 out of 10 most desired workplaces in Israel are High-tech firms, and 4 of those are foreign-owned.[61]

Many start-ups do not have the ambition to become the next multinational company such as Checkpoint (as elaborate on page 17), they strive to develop a product or technology innovative enough to be purchased by another, bigger company. From there they either continue working within that company, or cash out and use the new revenue to start another start-up. The size of the "exits" of successful companies has been record breaking in the past year.[62] Either way – those companies that strive to be bought by a bigger company do not distinguish between local, foreign, and multinational companies.

"Trust" has been in the center of this paper, and yet it is so hard to define and quantify. The multinational companies are trusted to be equal parts of the local eco-system, to respect the laws and customs, and not to take advantage of the smaller companies. But the multinationals also trust the viability of the state of Israel. With frequent military conflicts, and even more persistent collapses of governments before

[61] Heruti-Sover, Tali. "Israel's Best Employers: Tech Companies and Monopolies - Business." Haaretz.com. May 8, 2015. Accessed May 23, 2015. http://www.haaretz.com/business/.premium-1.655454.

[62] Note to self – mergers and acquisitions.

completing a full term, a phenomenon plaguing Israeli politics since the 90s, Israel is not an obvious candidate for long-term investment. Nevertheless, multinational companies trust that Israel's science and technology policy, as-well as the tax code and tax breaks will continue without interruptions regardless of the party holding the power. And indeed, the laws and policies that have influence over the start-up eco-system, have been consistent over the years.

The informal aspect of "Trust" is apparent in any and all interactions between the players in the eco-system. Trust infuses the interactions between firms, between firms and the government, between private sector and academia and so on. The acceptance of risk is another informal aspect of Israeli start-up culture. Risk, and even failure, are not only accepted, they are embraced. In one of the interviews for this research, an Israeli official told the author about the philosophy of the former Chief Scientist, Dr. Eli Opper – "…if our re-payment collection rate is high it means we failed. We authorized projects that were too easy; we didn't take enough risk…" Repeated over and over in meeting and memos, almost like a mantra of the OCS, this saying perfectly summarizes the mentality of innovation. Not failing means playing it safe, and not pushing the frontiers of the human knowledge further. And on the practical side of it: blue sky technology is viewed as a necessary means to expand country's options. The industry needs to be diversified and not dependent on any one field and "a bubble". Taking a risk and failure, are considered vital ingredients in this diversification. This acceptance of failure is echoed in the Silicon Valley eco-system, by one of the giants of the industry, Executive Chairman of Google: ***"Someone in a garage somewhere is gunning for us, and 2015 could be the year that they make their move. I know, because not long ago we were in that garage. And I know that the next Google will not do what Google does, just as Google did not do what AOL did."***

DISCUSSION AND POSSIBLE IMPLICATIONS FOR KOREA

On the surface of it, Israel has taken radically different path than Korea in its industrial policy. However, the countries have some characteristics in common which makes their paths interesting and beneficial to examine. Israel has no natural resources of its own. Like Korea, it was established in 1948 after devastating war, deep national trauma and a tumultuous colonial past in the previous year. And like Korea, Israel continues to live in somewhat uncertain geopolitical situation, which forces it to divert much of its GDP to military and national defense.

As detailed in the literature review of both the Silicon Valley and Israeli experience, several factors need to come together for emergence of start-up eco system. Korea has been exceptional in few of those parameters, which made the absence of high-tech innovation in small firms all the more puzzling.

First, Korea has a vast amount of world class high education. The Korean universities are consistently ranked at the top of world rankings, competing with western "ivy leagues". Of particular significance is KAIST, an advanced technological institute that competes with MIT in USA and attracts applicants from all over the world. Secondly, government-private sector cooperation is of great importance, as noticeable in the case of Israel and Silicon Valley. Korea's centralized planning was done in close cooperation since the 70s, and continues so to this day. Moreover, unlike in Boston or Bangalore, Korean military was influential in Korean recent history as it was in Israel and the early days of Silicon Valley. Korea's relative expenditure in R&D is slightly lower than in Israel – in 2014 Israel invested 4.4% of

its GDP in R&D, while Korea invested 4%.[63] However, with Korea's economy and GDP so much greater in absolute terms, the monetary investment in R&D is impressive.

Korea is consistently ranked very high by international organizations on parameters defined as "skills for innovation". For example, the OECD ranks Korea among the highest in their members in "fixed broadband subscriptions per population", "wireless broadband subscriptions per population", e-government development index", "patents filed by universities and public labs (per GDP)" and tertiary education expenditure (per GDP)". All parameters that are necessary for emergence of an innovation eco-system.[64] And yet, the start-up eco system in Korea is under-developed.

This study originally was conceived with examining the Korean case study in mind as a tool to strengthening the inner logic of the original argument. Such is the dynamic nature of Korean development though – this study was conceived and mostly written in 2014. At the same time, the new government, which was elected only in 2013, has made a large variety of innovations, improvements and re-structures in the science and technology sector of Korea, some of them in direct emulation of the Israeli model. In response to the fast, and yet still uncompleted restructuring process of the science and technology sector, this study was similarly restructured to focus on these changes, how they satisfy the conditions of a successful eco-system as outlined in the literature review, as-well as pointing out several directions for the future.

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[63] "Research and Development Expenditure (% of GDP)." World Bank. Accessed May 29, 2015. http://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS.

[64] "Science, Technology and Industry Outlook 20014 - Korea." OECD Library. Page 365 http://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-industry-outlook-2014_sti_outlook-2014-en

Academia-Government-Industry cooperation

While the academia in itself in Korea has been well regarded, the government has recently undertaken numerous steps to improve the collaboration between academia and the rest of the actors in the eco-system. The amount of higher education institutions and their respectability has been determined as not enough to influence the start-up eco system,. The higher education institutions need to engage with the rest of the eco-system, as-well as with each other and partners abroad, to ensure an influx of new ideas.

The public research system in Korea has been historically skewed towards applied and development-oriented research, much of which is performed in the Government Research Institutes in Korea that supplies technology for industrial R&D. The new government allocated USD 109 billion (KRW 92.4 trillion) over the next five years to expand *public* R&D capacity, including national R&D facilities in strategic areas. On the industry side - large manufacturing conglomerates are the main performers of R&D in Korea, with SMEs and young firms playing much smaller roles. The government also plans to stimulate the innovation system through the increase of the share of its investments in R&D going to SMEs from 12.4% in 2011 to 18.0% in 2017[65]

The government also started programs to support exchanges of professors and students between universities and research institutes, and plans to establish 18 new joint industry-university-PRI R&D centers by 2017.

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[65] "Science, Technology and Industry Outlook 20014 - Korea." OECD Library. Page 364 http://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-industry-outlook-2014_sti_outlook-2014-en

Greater shared use of S&T infrastructure to broaden access to S&T knowledge and information is also strongly encouraged. The government research institutes are required to devote 15% of their total budget to support SMEs by 2017 (compared to 7% in 2012) and 3% to transfer technology to SMEs and support human resources (compared to 1.76% in 2012).[66]

Finally, the government has not spared itself in this restructuring of the innovation eco-system. The Ministry of Science, ICT and Future Planning (MSIP) was established in 20013 to support the implementation of the initiatives that were elaborated above. The Ministry of Trade, Industry and Energy (MOTIE) grouped its trade functions with the R&D, industry and energy policy portfolio. In addition, a new National S&T Council under the Prime Minister's Office is the highest decision-making body on cross-agency STI policy issues. [67]

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66 "Science, Technology and Industry Outlook 20014 - Korea." OECD Library. Page 366

http://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-industry-outlook-2014_sti_outlook-2014-en

67 "Science, Technology and Industry Outlook 20014 - Korea." OECD Library. Page 364

http://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-industry-outlook-2014_sti_outlook-2014-en

Human capital: Diversity and Education

While the exact figures are unknown, Korea is also acutely aware of the problem of losing its human capital to overseas. Korea has approached the problem by focusing on luring the specialists back to Korea. The research by Lee and Kim (2010) is focused on the return rates of US doctoral recipients. Compared to India and China, Korea has relatively high percentage, with "brain drain of just 1.4%".[68] While the Chinese and Indian work with their respective diasporas in the USA and in particular Silicon Valley, the Korean government implements variety of programs to lure the scientists back – "the Brain Pool Program" for example, sponsored by the Korean Federation of Science and Technology Societies. The program invites Korean scientists and engineers abroad and offers temporary positions at universities and R&D institutes in Korea. Lowell (2004) also mentions Korea as a country which manages to "lure back migrants who have been abroad for many years" with strong investment in R&D environments and infrastructure.[69]

Patterson (2006) compares the diaspora-homeland cooperative development between several nations. The political influence of diasporas on their host nation, the technology transfer and financial contribution (remittance and investment) has been compared in the study. It points out Israel, China, India and South Korea as the most successful in those fields. However, Korea is singled out as a case of development IN the diaspora, meaning that the development goes in one direction, into the diaspora, unlike Israel and China where diaspora helps to develop

[68] Jenny J. Lee and Dongbin Kim. "Brain Gain Or Brain Circulation? U.S. Doctoral Recipients Returning to South Korea." *Higher Education* 59, no. 5 (05, 2010): 627-643. doi:http://dx.doi.org/10.1007/s10734-009-9270-5. http://search.proquest.com/docview/220945293?accountid=40940.

[69] Lowell, B. Lindsay, and Stefka G. Gerova. "Diasporas and economic development: State of knowledge." *Institute for the Study of International Migration, Washington DC* (2004).

the homeland.[70]

On the surface, the policies employed by Korea to lure it's specialists back, should have benefited Korea – they keep the best scientists in Korea, working for Korean companies and rather than educating the professionals and then lose a high percentage of them to the West, the government investment in Korean education brings high, and efficient, return rate. However, one of the necessary parameters for innovation is varied experiences and point of view, which come from diverse demographics. Korean professionals leave Korea for few years in favor of the West, than come back. Korea has not been successful in attracting foreign talent or in cooperating with its diaspora in the Silicon Valley; it is just tries to lure it back.

The efficient connection to diaspora has measurable, economic benefits, claims Saxanian (2002). "For every 1% increase in the number of first-generation immigrants from a given country, for example, California's exports to that country go up nearly 0.5%." Foreign-born professionals in Silicon Valley invest in start-ups or venture funds in their homeland countries. Currently, the leading groups of the investment in the homeland are Indian Diaspora with 22%, Taiwanese 17 % and mainland Chinese 10%,[71] the same groups highlighted by Patterson, Lee and Kim above.

As was discussed in the literature review, diversity of ideas and populations are important in establishing a successful entrepreneur culture. Both Korea and Israel has several bilateral international science and technology cooperation networks. However, so far Korea's tends to focus on the regional co-operation with China, Japan, Kazakhstan, Indonesia, Malaysia and so on, as well as

[70] Patterson, Rubin. "Transnationalism: Diaspora-Homeland Development." *Social Forces* 84, no. 4 (06, 2006): 1891-1907. http://search.proquest.com/docview/229872250?accountid=40940.

[71] Saxenian, AnnaLee. "BRAIN CIRCULATION. How high-skill immigration makes everyone better off." *Brookings Review* 20, no. 1 (2002): 28-31.

USA, as a close ally.[72] Only USA and China of those are significant R&D producers. Within the EU, so far Korea's cooperation is limited to only 9 countries, focusing only on the larger economies such as Germany, UK, Turkey and Sweden.[73]

Korea could expand its creative economy by stepping out of its comfort zone and expanding its R&D cooperation with more countries, in Latin America and Eastern Europe. Currently Israel and Korea cooperate under KORIL foundation (Korea-Israel Industrial R&D foundation). The foundation gives grants up to 1 million USD[74] to collaborative R&D between Israeli and Korean firm, as-well as working as sort of match-maker between the firms looking to expand their R&D. The grants are given on the conditions the innovation will be beneficial to both countries' economies. Israel mitigated the loss of human capital, by activating human capital worldwide, through more than 40 similar bilateral foundations and several multilateral. Expending its network of R&D collaboration, as-well as engaging the Korean diaspora abroad, could be a meaningful boost to the Korean innovation system.

Another program which could benefit the Korean innovation eco-system immensely: Korea is well below the OECD median for international co-authorship and co-patenting.[75] A traditionally strong focus on applied research and technological development performed largely in governmental research institutes are mostly to blame. With Korea being so ethnically homogenous, and the different actors in the

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[72] "International Cooperation." KISTEP - Korea Institute of S&T Evaluation and Planning. Accessed May 29, 2015. http://www.kistep.re.kr/en/c5/sub1.jsp.

[73] "Main Bilateral Programmes between Korea and EU." Access4.eu: RTDI PROGRAMME DATABASE. Accessed May 29, 2015. http://www.access4.eu/southkorea/630.php.

[74] "About KORIL-RDF." Korea-Israel Industrial R&D Foundation. Accessed May 29, 2015. http://www.koril-rdf.or.kr/english/koril/index3.php?seq=3&subseq=1_

[75] "Science, Technology and Industry Outlook 20014 - Korea." OECD Library. Page 366 http://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-industry-outlook-2014_sti_outlook-2014-en

eco-system competing rather cooperating with each other, new ideas have little opportunity to circulate. This OECD statistic is specifically surprising due to the fact so many of the Koreans study or work some time abroad as part of their work-life.

Co-invention and co-authorship with international partners could contribute to the "brain circulation" and the diversity of ideas, as-well as with bring new technology and opportunities to Korea. The low level of patent applications with foreign co-inventors is partly due to Korea's conglomerate industrial structure, which tends to retain technology development within the group.[76]

With so many changes in the government-industry-academia triple helix, this particular field remains Korea's next big challenge. Focusing on applied research only, and keeping it within the conglomerates, effectively kills the innovation opportunities. Further, it is also harmful for conglomerates themselves. Pooling their resources together, or simply investing in the eco-system on the whole and then just purchasing the successful innovation solutions developed by smaller firms, is cheaper than developing all the new technologies in-house. Microsoft, Intel, Cisco, HP, SAP, Motorola and IBM all successfully demonstrated that strategy in the past in Israel.

[76] Science, Technology and Industry Outlook 20014 - Korea." OECD Library. Page 366 http://www.oecd-ilibrary.org/science-and-technology/oecd-science-technology-and-industry-outlook-2014_sti_outlook-2014-en

Informal networks, trust and risk taking culture

It is important to note, that all factors influencing the development, or failure to do so, discussed in the paper so far, are institutional. The triple helix of government-education-private sector are all formal institutions, but the cooperation and communication between them is often through informal channels such as the security network in Israel, or through ethnic professional association in Silicon Valley.

In Korea in particular, there are both formal and informal institutions that stand in a way of a successful start-up eco-system: the structure of the economy, including the governmental assistance, is encouraging innovation, but in the big corporations and not small private companies. The government also encourages the Korean diaspora to return, but does not connect with Koreans abroad, such as those found in Silicon Valley.

But it is also important to note that the culture itself is a part of the influencing factors, and many returnees return because they want to. The same article by Lee and Kim, found that many candidates that returned to Korea after study in the US, did so simply because they initially took the opportunity to study or work in the USA as means to advance in Korea later on. The connection of Korean diaspora with the homeland cannot be only attributed to formal institutions, but to more informal codes of conduct and values, that require deeper discussion on the nature of informal institutions that serve as an obstacle to possible reform in Korea.

VI. CONCLUSION

This paper attempted to answer what factors have made Israel a successful incubator for start-up businesses. The introduction elaborated on some of the features and successes of the Israeli case. The first part of the literature review sketched a theoretical framework for research of start-ups. It was complimented by looking at some of the unsuccessful start-up eco-systems in the world and the factors that were lacking in those cases. The author then concluded that the factors that were lacking in those failure cases, were the same factors that were integral for the success of eco-system such as in Silicon Valley. Most of the research into start-ups is relatively recent, and lacks a systematic approach, even more so in the case of Israel. Focusing on the research globally, and extending it to failures, helped mitigate that challenge somewhat. In the second half of the literature review, the research that looks directly at the case of innovation in Israel was examined. The same factors were repeated such as in the elsewhere global case studies: the human capital factors such as education and diversity of backgrounds and ideas, the government-private sector-academia cooperation, and the informal networks and factors such as "trust", "risk-taking" and "risk sharing" were also discussed. In the course of the research, additional aspect of the Israeli case study was added – multinational companies. Not a separate issue by itself, the multinationals were allowed to flourish in Israel due to both favorable conditions set by the Israeli government, and cooperation and trust from other actors in the eco-system and the general public.

In the discussion portion of the paper, those factors were applied to the case of South Korea, which is a prime example of a country with high quality of

human capital, and which could potentially be the next thriving eco-system. The cases of South Korea and Israel are not perfectly compatible. More thought and research should be devoted in the future of linking the development of these two countries. The two countries themselves desire to be linked together, and the steps the Korean government took recently to adapt the "start-up nation" model to the Korean case. Further research into the applicability of the Israeli research elsewhere could benefit other countries striving to develop knowledge based economy, as-well as help building a more comprehensive theory of high-tech innovation.

VII. SIGNIFICANCE AND FURTHER RESEARCH

Maximization of resources has always been a matter of great concern for most nations. This issue is poised to be the most important question of the 21st century, on national and global levels. Natural resources are limited and growing thin, but human potential is still poorly utilized.

While prevention of natural disasters or ecological damage is hampered by politics, human inventiveness allows us to work around objective adversity like climate change, and in the future will be our greater resource. Maximization of human capital on a national level would benefit all, but particularly developing countries.

One future direction for this research is applying the Israeli start-up model on the economy of South Korea. Both are relatively small nations with limited natural resources, high military spending, and highly educated populations. Applying the Israeli model of start-up economy to the case study of South Korea would provide answers to a subsidiary research question: Given the similarities between Israel and South Korea what strategies and policies could South Korea adopt to create a similar start-up Eco-system? If proven to be successful, adapting the Israeli model to other knowledge based economies can provide an incentive for developing more knowledge-based economies elsewhere.

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