International Journal of Innovation and Scientific Research
ISSN 2351-8014 Vol. 22 No. 2 Apr. 2016, pp. 444-455

http://www.ijisr.issr-journals.org/

Innovation Ecosystems: Practice vs. Prevailing Perceptions

Yifat Turbiner[1], Dafna Schwartz[1], and Raphael Bar-El[2]

[1]Guilford Glazer School of Business and Management, Ben Gurion University of the Negev,
P.O.B. 653 Beer-Sheva, 84105, Israel

[2]Department of Applied Economics and Management Sapir Academic College,
D.N. Hof Ashkelon 79165 Israel

ABSTRACT: In recent years, researchers and policymakers have become increasingly interested in identifying the factors that explain the success or failure of innovation efforts. Recent studies around the world use the concept of a "national innovation ecosystem," and identify several key factors within this ecosystem that influence the emergence of innovation.
The purpose of this article is to evaluate the extent to which the Israeli practice, which has led to notable results, is actually in line with the perception presented in literature. The analysis is based on in-depth interviews with 25 leaders who shaped Israeli innovation processes over the past two decades, from government, academia and industry.
The findings show that the Israeli practice is explained by the same factors as shown in world literature, but an evaluation of the relative importance of each factor reveals quite surprising results. The contribution of main factors such as Government and Academia was evaluated as moderate, while the contribution of Culture was considered as major. This may be explained by the possible influence of the evolutionary and dynamic nature of the innovation ecosystem, where the nature of the contribution of each factor changes during the process.

KEYWORDS: national innovation system; venture funding entities; culture; academia; government, IT infrastructure.

1 INTRODUCTION

Given that the positive results of innovation have been understood now for many years, effort is being invested into understanding what feeds innovation and how its development can be influenced. The attempts at cracking the code for emergence of innovation have led to the development of various approaches, including the innovation ecosystem approach. This approach reflects the complexity of the innovation process, as we currently understand it, including interrelations, dependence and mutual influences between the various factors that take on forms and develop in a manner that is evidently not spontaneous.

However, despite the fact that various factors in the innovation ecosystem were found to make an important contribution to the emergence of innovation - such as academia, government, financial entities, etc., there is less research information about the hierarchy of their contribution to the emergence of innovation as part of a given innovation ecosystem. Furthermore, the answer to the question of development of the innovation ecosystem and the contribution of the various factors to emergence of innovation during the various stages of the ecosystem's development have yet to become clear enough to facilitate definition of an innovation policy that will support the existence of a dynamic, competitive and sustainable ecosystem.

This article focuses on Israel's national innovation ecosystem at present. Israel has impressive achievements in the field of innovation compared to any standard, as can be seen through various indicators published in world statistics. Thus, for example, Israel was ranked first in the world for innovative capacity by the IMD Global Competitiveness Yearbook 2014 and third for innovation globally out of 148 economies by the WEF Global Competitiveness Yearbook 2014-2015. Israel was also

Corresponding Author: Yifat Turbiner

ranked in these reports as first for business expenditure on R&D, first for entrepreneurship, second for scientific research, and third for information technology skills. In fact, apart from Silicon Valley, the highest concentration of high-tech companies in the world is found in Israel [1].

The purpose of this article is to establish whether the Israeli experience has unique characteristics when compared to experience accrued in other countries, as is reflected in the literature relating to defining the key active forces in the national innovation ecosystem.

This article is organized as follows: the first part briefly presents the concept and components of a national innovation ecosystem, as described in the international research literature. It is followed by a presentation of the research hypotheses and methodology designed to examine it. The third part of the article includes the research findings and the discussion of these findings. Finally, the main conclusions arising from this study are presented.

2 THE MAIN FACTORS IN THE NATIONAL INNOVATION ECOSYSTEM AS SEEN IN THE LITERATURE

Since the end of the 20th century, the national ecosystem approach has been developed to analyze and understand the dynamics of innovation. The approach borrows the biological ecosystem model and implements it in a socioeconomic context [2, 3, 4]. Accordingly, the innovation ecosystem includes both the economic agents as well as the non-economic agents such as technology, culture, communications, etc. [5]. Among other things, the advantage of this approach is that it is holistic in the sense that it relates to a wide variety of factors that work together (in both planned and unplanned manner) to generate shared value, in the unique dynamic of a defined locale [6, 7]. Metcalfe and Ramlogan [6] argue that innovation ecologies are national by nature and reflect the laws, language, culture, business practices and sociopolitical regulations of businesses in their local economies. In contrast, innovation systems are problem- or challenge-centered, which arise for a particular purpose. As they perceive it, innovation ecology contains and supports several innovation systems. The distinction between an innovation system and innovation ecosystem is not self-evident. Some use this term as a synonym for innovation system, emphasizing the spatial aspect. However, others believe that the main difference between the two concepts is inherent in the level of planning involved in the innovation activity. While an innovation system tends to be planned and goal oriented, an innovation ecosystem constitutes all the conditions for the emergence of innovation, both planned and those that exist without advance planning. A developed innovation ecosystem enables the various players within it to function beyond their natural boundaries (such as the boundaries of the organization in which they are members) and thus support the transformation of knowledge into innovation [5]. In this sense the innovation ecosystem is a continuation of the line of thought on open innovation presented by Henry Chesbrough in 2003.

2.1 WHO ARE THE KEY PLAYERS IN THE INNOVATION ECOSYSTEM?

2.1.1 GOVERNMENT AND PUBLIC AGENCIES

The research literature shows that Government and Public Agencies play a central role in leading innovation and that they are actually key and highly influential innovation agents in the innovation ecosystem. The contribution of these factors to the emergence of national innovation is described as being broader and more comprehensive than addressing market failures and includes a variety of interventions in different contexts and time intervals [8]. The means for promoting innovation that are available to the Government and Public Agencies include both direct support of industrial R&D, deployment of physical infrastructures, financing of basic research, education and development of human resources as well as means that can stimulate innovation processes, which are not based on conventional expansionary fiscal policy such as tax incentives, enacting laws, regulations and agreements (for example, tax policy, copyright protection, international cooperation agreements, immigration policy, etc.). It was further found that the government, being the largest buyer in the economy, plays a significant role in promoting innovation by generating demand for innovation through government procurement, which drives the wheels of the economy and creates a source of research and technology innovation [6, 9, 10, 11, 12, 13, 14]. The Israeli government has generally received international recognition for its economic policy, which relates to growth and innovation challenges. Furthermore, a positive correlation was found between government programs and actions in the field of innovation and various aspects of innovation, as seen in the Israeli economy. Two salient examples in this regard are the Technological Incubators Program and the Yozma Program, which were successfully implemented by the government at the beginning of the 1990s [15, 16, 17, 18].

2.1.2 ACADEMIA AND RESEARCH INSTITUTES

Research literature shows that Academia and Research Institutes have a marked impact on the emergence of innovation, which can be seen in the creation of two critical components of innovation - human capital and knowledge. These inputs form the foundation of applied research, product and process innovation in industry [19, 20, 21, 22, 23, 24]. Moreover, over the years, the role of universities in the field of innovation evolved into active involvement in the economy, as evident in the concept of the 'entrepreneurial university'. This development occurred at the same time as the innovation process was transformed from being internal within a firm to one that extends beyond those limits and includes a wide variety of external parties, which in turn gave Academia and Research Institutes room to act [25].

2.1.3 VENTURE FUNDING ENTITIES

The importance of the financing bodies in the emergence of innovation can be seen, firstly and foremostly, through their being suppliers of capital and virtually the only source of financing for entrepreneurial and innovation activity which entails great risk. A strong financial system includes a wide range of financing parties and enhances the efficiency of innovation activity. The opposite is also true: the lack of venture financing entities has been found to be a barrier to innovation activity and economic growth [26, 27, 28]. Furthermore, the contribution of these entities to the emergence of innovation is also manifest in other aspects that improve the odds of success for innovative ventures such as monitoring of venture development, assistance in building quality management teams, mentoring based on know-how and professional experience, connections to local and global networks, providing a strong reputation to the funded companies, and more [29].

Over the past twenty years, the importance of the Venture Funding Entities has grown significantly. Two main trends have had an impact on these players and their role in promoting innovation. One is globalization, and the other is technological development during this period. These trends are interrelated and have led to a marked increase in global investments made by the various financing bodies as well as a dramatic decline in the costs required to start an innovative venture and, accordingly, creating a variety of new types of experting financing entities (such as micro funds and crowdfunding) [30, 31].

2.1.4 CULTURE

The findings of the various studies provide empirical evidence of the marked impact of Culture on the national and organizational level of innovation. Cultural values such as tolerance of risk and failure, individualism, low power distance and lack of formality were found to have a positive impact on the emergence of innovation and also to explain the difference in the level of innovation between countries. These findings indicate that an attempt to increase innovation through means such as increasing the resources directed at research and development or building industrial infrastructures that support innovation may prove futile without promoting cultural values that support innovation [32, 33, 34]. Similarly, a tendency towards networking, pluralism, cultural openness, spirit of authenticity, engagement and common purpose were also found to be elements that explain the power of certain innovation ecologies and firms over others [35, 15, 36, 37, 38, 39].

2.1.5 TECHNOLOGY

Information and Communications Technology (ICT) is described in the literature as having a substantial impact on increasing efficiency and productivity of innovation activities. In general, a strong correlation was found between the degree of development of ICT infrastructure and the country's level of innovation [40]. As a result, many countries attribute a great deal of value to the development of technological infrastructure that supports innovation and to increasing its use. A developed ICT infrastructure significantly reduces the impact of geographic distance on the emergence of innovation and serves as a catalyst for its formation by reducing the costs associated with innovation activities and raising capital, making global platforms of knowledge and information accessible, and enhancing the ability to share, process, discuss and distribute information [41, 27, 42, 43, 44, 30, 45].

3 THE INNOVATION ECOSYSTEM IN ISRAEL - RESEARCH HYPOTHESIS AND METHODOLOGY

3.1 RESEARCH HYPOTHESIS

In this study, which is essentially an exploratory study, we sought to determine the main factors at play in the innovation ecosystem in Israel and whether the factors identified in the international research literature as being central and essential to the emergence of innovation are also key in today's Israeli innovation ecosystem. Therefore, the main hypothesis of the study is that the national level of innovation depends on the performance of the factors at play in the innovation ecosystem, the primary of which are Government and Public Agencies, Academia and Research Institutes , Venture Funding Entities, Culture and Technology.

Beyond identifying the main factors in the innovation ecosystem, we also wanted to evaluate the contribution of each factor, in and of itself, to the emergence of innovation in Israel. Based on the research literature, which describes these factors as main anchors that strongly influence the level of innovation, a secondary hypothesis was derived, according to which each of the above mentioned key factors has a considerable influence on the emergence of innovation in the Israeli economy.

3.2 METHOD

The study included field work in the form of semi-structured in-depth interviews with key players in the Israeli innovation ecosystem. The findings of the interviews were analyzed and examined against the international research literature.

The group of interviewees included 25 well-placed key players in the Israeli innovation ecosystem, who were carefully selected from a variety of sectors (see Table 1) and based on their contribution, work and prominence on the Israeli innovation scene. In this regard, it is noteworthy that all of the experts invited to participate in the study agreed to do so.

The group of interviewees included, among others, the chief scientists who guided the government policy in the field of innovation over the past several decades, leading academic researchers and highly prominent leaders in the industrial sector who implemented important innovation projects in industries with diverse technological intensity.

This is naturally not a random sample of interviewees, nor a survey of opinions about the reasons behind the growth of the innovation process in Israel. This is an indepth collection of information from a group of persons who actually conceived and built the process of innovation in Israel during the last decades. The collected information included actions taken by each of the interviewees in the process of innovation, relationships with other representatives of the ecosystem, evaluation of the inflluence and actual effects of such actions and relationships.

Table 1 - Description of the Group of Interviewees According to Sectoral Affiliation

Sectoral affiliation	Number of interviewees	% of all interviewees
Industry	17	68
▪ High tech	10	59
▪ Non high tech	7	41
Academia	3	12
Government	5	20
Total	25	100

Furthermore, it is noteworthy that 60% of the interviewees have diverse experience and sectoral backgrounds, beyond the sector with which they are affiliated and which they represent in the study. These interviewees have great importance in a study dedicated to examining the operation of the innovation ecosystem, as their heterogeneous experience allows them to provide the integrative and holistic perspective of the innovation scene.

The interviews were conducted in 2013-2014 and included questions regarding the key factors in the Israeli innovation ecosystem and their contribution to the emergence of innovation. Some were open questions (without options to choose from) and others were questions in which the interviewees were asked to rank their responses on a scale of four values: Significant, Moderate, Minimal and Not at all. The numeric values assigned to the ratings are: 3, 2, 1 and 0, respectively. In this regard, it is important to stress that in terms of the identity of the key players in the innovation ecosystem, an open question without optional answers was presented, with the range of answers being consolidated into key factors.

Analysis of the data included a breakdown by three parameters: (1) sectoral affiliation (industry, government or academia), (2) the experience and background of the interviewee (heterogeneous or homogeneous) and (3) industrial affiliation according to technological power (high tech or non-high tech).

4 FINDINGS

In general, it was found that the five factors found in the research literature to be significant in the emergence of national innovation, meaning - Government and Public Agencies, Academia and Research Institutes, Venture Funding Entities, Culture and Technology, were also noted by the interviewees in this study as key factors in the Israeli innovation ecosystem, which supports the research hypothesis.

In the next phase, the interviewees were asked to evaluate the contribution of each of the aforementioned main factors to the emergence of innovation in Israel today. This evaluation was performed through presentation of a closed question that included a four-point scale for each factor: (A) Significant contribution, (B) Moderate contribution, (C) Minimal contribution, and (D) No contribution at all. In this regard, analysis of the findings demonstrates that the contribution of the main factors to the emergence of innovation is not perceived as equal and there is a clear hierarchy in how the interviewees evaluate their contribution. Culture is perceived by the interviewees as having the greatest contribution of all five factors, with the contribution of Technology coming second behind Culture. The contribution of Venture Funding Entities as well as the Academia and Research Institutes to the emergence of innovation was found to be moderate, and the contribution of the government was perceived as being moderate to low (see Table 2 below).

The research literature that deals with the factors involved in the innovation ecosystem does not relate to their relative importance and the ranking of their contribution to the emergence of innovation and the assumption is that they have equal importance. However, that was not what was found in the current study.

Table 2 - Ranking of the Contribution of the Main Factors in the Israeli Innovation Ecosystem to the Emergence of Innovation

Average Ranking / Main Factors	Overall	Sector affiliation			Background		Technological Intensity**	
		A	G	I	Hetero-geneous	Homo-geneous	Non-High Tech	High Tech
(n)	(25)	(3)	(5)	(17)	(15)	(10)	(10)	(7)
Culture	**2.9 [0.3]**	3.0 [0.0]	3.0 [0.0]	2.8 [0.4]	3.0 [0.0]	2.7 [0.5]	2.7 [0.5]	2.9 [0.3]
Technology	**2.3 [0.7]**	1.3 [0.6]	2.3 [0.5]	2.5 [0.6]	2.3 [0.7]	2.4 [0.7]	2.7 [0.5]	2.4 [0.7]
Venture Funding Entities	**2.1 [0.9]**	2.0 [1.0]	2.6 [0.5]	1.9 [1.0]	2.3 [0.9]	1.8 [0.9]	1.8 [0.8]	2.0 [1.1]
Academia and Research Institutes	**2.1 [0.9]**	2.7 [0.6]	2.0 [1.0]	2.1 [0.9]	2.1 [1.0]	2.2 [0.8]	2.1 [0.7]	2.0 [1.1]
Government and Public Agencies	**1.9 [0.9]**	2.0 [1.0]	2.4 [0.5]	1.7 [0.9]	2.0 [0.8]	1.7 [0.9]	1.9 [0.9]	1.6 [1.0]
Average	**2.3 [0.4]**	2.2 [0.6]	2.5 [0.4]	2.2 [0.5]	2.3 [0.4]	2.2 [0.4]	2.3 [0.5]	2.2 [0.5]

* *The standard deviation in each category appears in square brackets.*

** *This category includes a breakdown of interviewees who belong solely to the industrial sector.*

*** *Legend: A = Academia; G = Government; I = Industry, (n) = Number of interviewees*

Examination of the research literature against the findings of the interviews indicates that in certain fields there is a gap in the evaluation of the contribution of the various factors to the emergence of innovation (see Figure 1).

This gap is expressed in the interviewees' underevaluation of the contribution of the Government and Public Agencies, Academia and Research Institutes, and Venture Funding Entities to the emergence of innovation in Israel today. To a certain extent, it is also reflected in the overevaluation of the contribution of the Culture factor to the emergence of innovation in Israel today.

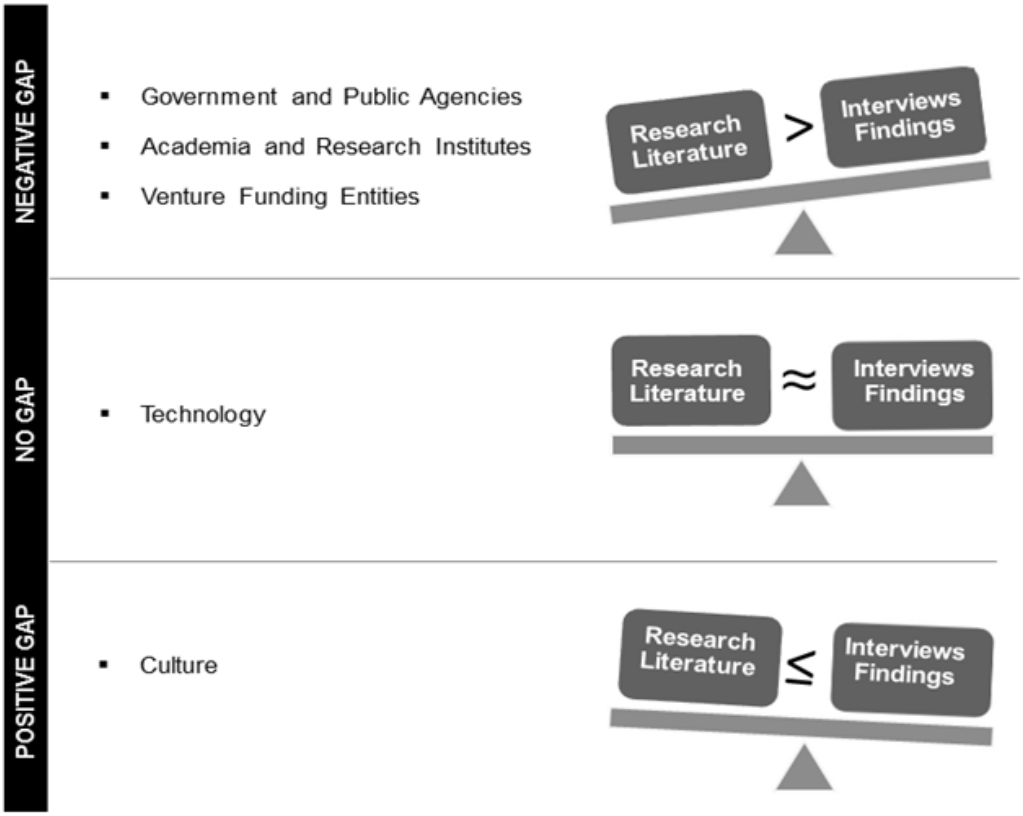

Figure 1: Gaps between the Research Literature and the Findings of the Interviews by Factor

Below are the field work findings and their examination in light of the research literature for each of the five central factors in the innovation ecosystem as identified in this study:

4.1 GOVERNMENT AND PUBLIC AGENCIES

Despite the evidence in the research literature regarding the importance of the contribution of Government and Public Agencies to the emergence of national innovation, the findings of the interviews show that on average, the interviewees in this study did not perceive their contribution in the current period as significant and ranked it as lower than moderate in power (average score 1.9 out of 3). Moreover, the Government and Public Agencies were rated relative to the other factors examined in this study as having the lowest contribution to the emergence of innovation in Israel today. This finding is especially interesting given the fact that half of the interviewees who belong to the industrial sector received support from the government to finance their innovative activity.

As can be seen in Table 1, the contribution of Government and Public Agencies to the emergence of innovation is stable, and is generally ranked, relative to the other groups of factors, as having a low contribution to the emergence of innovation. However, the high average score given to the contribution of Government and Public Agencies by the interviewees belonging to the government sector and the relative homogeneousness of their scores was salient (average score 2.4, standard deviation 0.5), particularly compared to interviewees in the academic and industrial sector. The latter rated the contribution of Government and Public Agencies as moderate to low (average score 2.0, and 1.7, respectively). An examination of the breakdown of the industrial sector according to technological intensity of the industries to which they belong indicates that the interviewees who belong to the high-tech industries (the focus of innovation in Israel) tend, on average, to estimate the contribution of the Government and Public Agencies as lower than those in sectors other than high tech (average score of 1.6 and 1.9, and standard deviation of 1.0 and 0.9, respectively).

It is important to note that despite the relatively low score interviewees gave the contribution of Government and Public Agencies in the emergence of innovation in Israel today, it was clear in the interviews that there was a consensus that the Government and Public Agencies in general have a strong potential influence on the emergence of innovation. Most of the interviewees even praised the work of the government to encourage innovation at the very earliest stages of the emergence

of the innovation ecosystem in Israel and noted the gap that exists between the contribution in the past and present, when the innovation ecosystem is already developed.

4.2 ACADEMIA AND RESEARCH INSTITUTES

A gap between the literature and the findings of the current study was also found with respect to the relative contribution of the Academia and Research Institutes to the emergance of innovation. On average, the interviewees in the study attribute only a moderate contribution of Academia and Research Institutes to the emergence of innovation in Israel today (average score 2.1). Furthermore, a difference was found in the evaluation of the contribution of this factor by those in the academic sector and those in the government and industrial sectors. As can be seen in the analysis in Table 2, interviewees in the academic sector attribute great importance to the contribution of Academia and Research Institutes to the emergence of innovation in Israel (average score 2.7 and standard deviation 0.6). In contrast, interviewees in the government sector scored the contribution as being moderate (average score 2.0) and having the lowest relative importance of the five factors.

A breakdown of the group of experts by background and sectoral experience as well as the technological intensity of the industries to which the interviewees belong indicates similar results - namely that the contribution of academia is moderate and was ranked fourth among the five factors examined.

4.3 VENTURE FUNDING ENTITIES

As opposed to what is standard in the literature, it was found that the Venture Funding Entities are perceived by the interviewees as having only a moderate influence on the emergence of innovation in Israel today (see Table 2). The average score given to the contribution of these factors to the emergence of innovation in Israel is lower than that for Culture and Technology, the same as that for Academia and Research Institutes, but higher on average than that for government. Even in this regard, it was found that the score for this factor differed between the various sectors. Interviewees from the government sector evaluated the contribution of the Venture Funding Entities as significant and ranked them second (average score 2.6, standard deviation 0.5). In contrast, the interviewees in the academic and industrial sector ranked their contribution as moderate (average score 2.0 and 1.9 respectively). Furthermore, it was found that interviewees with a heterogeneous background ranked the contribution of the Venture Funding Entities to the emergence of innovation as higher than did interviewees with a homogeneous background (average score 2.3 compared to 1.8).

4.4 CULTURE

The factor that was found to have the most significant contribution to the emergence of innovation in Israel is the local culture (average score 2.9, standard deviation 0.3). The low standard deviation demonstrates the high level of homogeneity in the interviewees' responses.

In their book, *Start-up Nation*, Senor & Singer [46] describe Israeli culture as being devoid of hierarchies and formality, a culture that includes a willingness to work hard, dedication, mutual responsibility, willingness to take risks and a unique approach to failure. This description is to a great degree in line with the responses of the interviewees, who stated that these cultural values form the foundation for the success of Israeli innovation. In this regard, they specifically mentioned the tolerance of failure in Israeli society, according to which failure is legitimate and is a step on the path to success. The common perception among the interviewees is that failure improves the odds of success in the future, as it is reasonable to assume that someone who has failed once will not repeat the same mistakes. This attitude was found to enable risk taking, which has a positive effect on the tendency to be involved in innovation.

According to the unique attitude towards failure found in Israel, it was found that Israeli culture is not averse to situations marked by uncertainty. In this context, a large number of the interviewees noted the contribution of military service in Israel as a factor that shapes and influences the perception of risk and ability to maneuver in conditions of uncertainty. It combines original thought with initiative and strong performance that later translate into a culture that supports innovation in the business arena. Thus, for example, Eyal Waldman, founder, President and CEO of Mellanox Technologies (defined as one of Israel's greatest high-tech success stories), said, "The combat units in the Israel Defense Force are a survival arena, in which soldiers learn how to solve problems creatively, take risks, improvise and the like. These skills help them later when involved in innovation in their civilian lives."

Other cultural aspects noted in the interviews as supporting innovation include the tendency to challenge conventions, thinking outside the box, strong improvisational skills and a strong tendency to network.

From the statements made by the interviewees in this study, it is clear that Culture is a key element on the national innovation scene and is the "secret ingredient" in the Israeli innovation "recipe." They argue that while other factors in the innovation ecosystem (such as Technology and Venture Funding Entities) that influence the level of innovation are also found in other innovation ecologies, the special culture in Israel is perceived as being a differentiating factor and the underlying reason for the success of Israeli innovation. A review of the literature shows that there is a strong correlation with the attitudes of the interviewees in matters related to the contribution of Culture to the emergence of national innovation.

4.5 TECHNOLOGY

The findings of the interviews show the positive contribution Technology has on the emergence of innovation, and are in line with those in the literature. This factor was ranked second among the five factors examined in this study (average score 2.3 and standard deviation 0.7). Furthermore, these findings were stable even in the breakdown by the different parameters. What was outstanding was the relatively low ratings given by interviewees in the academic sector in Israel (average score 1.3, standard deviation 0.6). The interviewees' statements show that this is evidently due to reference to different aspects of this infrastructure when providing the rating. While most of the interviewees from the industrial and government sector related to Technology as a factor in the innovation ecosystem that allows the flow of information and connectivity between the various factors at the core of innovation. The interviewees in the academic sector related to the technology infrastructure mainly as a research infrastructure, and in this regard ranked it as having a low contribution to the emergence of innovation.

5 DISCUSSION

The underlying assumption of this study was that innovation arises within the framework of an innovation ecosystem. As a result, identifying the main components and assessing the extent of their absolute and relative impact on the emergence of innovation is very important.

In this study, we attempted to examine this question based on the Israeli experience which serves as a striking example of a small country that is geographically remote from global markets, but within a short time was able to transform itself into a country know for its innovation.

The study included in-depth interviews with a unique sample of key players on the Israeli innovation scene. Through these interviews, we attempted to establish the identity of the key factors in the Israeli innovation ecosystem and their contribution to the emergence of innovation. A literature review shows that the main factors identified as important to the emergence of innovation include the Government, Academia and Research Institutes, Culture, Technology and Venture Financing Entities.

The findings of the study support the research hypothesis that in Israel, as shown in the literature, the main anchors in the innovation ecosystem are the Government and Public Agencies, Academia and Research Institutes, Venture Funding Entities, Culture and Technology.

However, examination of the interviewees' evaluation of the contribution of these factors to the emergence of innovation in Israel today demonstrates that their contribution is not perceived as being equal and that there is a clear hierarchy in the interviewees' evaluations of their contribution.

An examination of the findings of the study in light of the literature from around the world demonstrates that in certain fields there is a gap between the research literature and the positions of the interviewees, as expressed in this study (see Figure 1). Two types of gaps were found. One is negative and relates to the factors Government and Public Agencies, Academia and Research Institute and Venture Funding Entities. This gap indicates that the interviewees in this study perceive the contribution of these factors in the ecosystem to the emergence of innovation as lower than that described in the literature. The other gap, is essentially positive and points to the strength of the interviewees' perceptions of the contribution of Culture to the emergence of innovation in Israel.

As far as the negative gaps revealed, they do not detract from the interviewees' evaluations of the importance of the contributions of these factors to the emergence of national innovation. Based on the statements made by interviewees in this study, we can see that these gaps are attributable to the fact that they related to the current contribution of these factors, when a developed innovation ecosystem exists. The rating of the contribution of the three factors listed above (namely, the Government and Public Agencies, Academia and Research Institutes and Venture Funding Entities) to the emergence of innovation in Israel is evidently based on a distinction between their contribution, role and assistance in the emergence of a developed innovation ecosystem in Israel and the contributions currently require to maintain the innovation ecosystem competitive, dynamic and sustainable. The interviewees related to the first of these as givens, so that in fact, their

ranking of the contribution of the various factors to the emergence of innovation was to a strong degree based on other aspects of these factors related to enhancement of the Israeli innovation ecosystem today. For example, government support for industrial R&D provided through the Chief Scientist's Office of the Ministry of Economy was perceived by most as a given and, at times even noted as being less essential and effective now, when the Israeli venture capital industry is among the world's most developed (as opposed to the case at the beginning of the 1990s, when Israel was in the initial stages of developing its innovation ecosystem and the financing for innovation provided by the government was almost exclusive and, therefore, critical to the emergence of innovation). According to the interviewees in this study, the government should have a broad perspective of the field of innovation that includes emphasis on actions beyond support of industrial research and development. Infrastructure aspects of Israel's innovation ecosystem, including educational infrastructure, regulatory and physical infrastructures, were noted by the interviewees as being critical to promoting innovation in Israel today.

In this regard, the interviewees argued that the government does not adapt as required or do so at the pace, strength and coordination that is less than optimal. They claim that the government has a key role and important potential contribution to the emergence of innovation, but must adapt its policy tools to the innovation ecosystem's development stage, through an ongoing dialog with the business sector.

Similarly, the interviewees related to the financing aspect of the contribution of the Venture Funding Entities as a given, and underevaluated it when estimating their overall contribution to the emergence of innovation. In other words, the interviewees tended to rank the contribution of the added value of the Venture Funding Entities to the emergence of innovation beyond the financing itself, which is perceived as a given. The diverse and accessible range of Venture Funding Entities in the Israeli innovation ecosystem today along with the technological developments that have significantly reduced the initial financing required for innovation activities, can explain why the issue of financing, in and of itself, despite its importance, is not perceived by the interviewees in this study as the most important contribution of the Venture Funding Entities to the emergence of innovation in Israel today. Most of the interviewees viewed the added value of these financing entities as their main contribution to the emergence of innovation. Some even mentioned it as being highly significant and more important than the financing aspect. For example, Dr. Yossi Vardi, a very prominent figure on the Israeli and global innovation scene, said, "What's more important than the financial investment itself is the training, consulting and mentoring that entrepreneurs receive from the Venture Funding Entities... The financing itself is important, but its importance is much lower than the contribution made by the mentoring and guidance of the entrepreneur."

In this regard, aspects such as connections to global networks, consulting, guidance and business training were mentioned by the interviewees as most important to the emergence of innovation in Israel today. From the interviewees' statements, we can see that the "smart money" aspect the Venture Funding Entities are supposed to bring with them (meaning the added value beyond pure financing), is not reflected sufficiently in the Israeli innovation ecosystem at present. Therefore, the ranking of their contribution to the emergence of innovation today is only moderate.

Furthermore, when evaluating Academia and Research Institutes, the interviewees related to their traditional contribution (human capital and know-how) as a given and underweighted it when evaluating its overall contribution. They further focused on the gap between the potential contribution of Academia and Research Institutes to the emergence of innovation for economic ability and their actual perceived contribution. This gap is not surprising and stems from the different objective functions of the various sectors. While academia is measured according to indicators such as publications and scientific achievements that are not necessarily applicable in the short term, industry strives to maximize its profits in the short term and therefore promotes applicable research. The difference between academic and business culture is seen both in the different perceptions of time and the conflict of interest regarding publication of studies. According to most of the interviewees in this study, Academia and Research Institutes do not work effectively and exhaustively in the field of innovation, which as previously noted, developed over the years and is based on partnerships in all aspects of the innovation process. The interviewees in this study perceive Academia and Research Institutes as key agents of innovation and as playing a significant role, beyond training human capital and generating knowledge. Most of them believe that these organizations must be more actively involved in the economy.

Evidence of this can be found in the following quote by Mooly Eden, former Senior Vice President and President of Intel Israel, "The main contribution of academia in Israel to the emergence of innovation is seen in scientific research and the quality of the human capital trained at its facilities. However, in fact, academia has the potential to make a greater contribution to innovation than it does today. This potential is untapped due to a lack of meaningful relationship with the industry in Israel." The findings of the study indicate the importance of creating mechanisms that will coordinate and integrate the activity of Academia and Research Institutes with the requirements and needs of the industrial sector. Most of the interviewees recognized the fact that in recent years, the scope of activity on academic campuses to promote entrepreneurship and innovation has increased dramatically, but they claim that this development is slow and less than what

is required. This explains why the contribution of Academia and Research Institutes to the emergence of innovation in Israel today was ranked as only moderate.

Beyond what is set out above, at times there seemed to be a lack of correspondence between the interviewees' evaluation of the contribution of the factor to which they belong sectorally in this study and the way in which interviewees from other sectors evaluate the contribution of the same factor to the emergence of innovation in Israel. For example, interviewees assigned in this study to the government sector, on average evaluated the contribution of the Government and Public Agencies to the emergence of innovation in Israel as higher than interviewees from the academic and industrial sector (see Table 2). A similar finding was also found for academic and research institutes. The contribution of which to the emergence of innovation in Israel was ranked by interviewees in the academic sector as significantly higher than the rating of its contribution by interviewees from the government and industrial sector. This finding may indicate the existence of knowledge gaps between the different sectors regarding their activities in the field of innovation, which may reflect connectivity and coordination problems in the Israeli innovation ecosystem.

As far as the positive gap found in terms of Culture, the findings of the interviews show that there is correspondence with the research literature and beyond. The local culture was found as having the greatest impact and contribution to the emergence of innovation in Israel on every dimension and according to any breakdown performed in this study. Specifically mentioned in this regard was the tolerant attitude in Israel towards failure, the tendency to take risks (evidently attributable to the tolerant attitude towards failure), tendency to challenge conventions, critical thinking, persistence, low power distance and lack of formal mannerisms. Another cultural dimension found to support innovation and to be very typical of Israeli culture is the tendency to develop and nurture social and business networks both at the local and global level. Examination of all aspects of Israeli culture indicate that, indeed, Israeli culture supports innovation and drives its strength from a variety of sources that come together to transform it into the most significant component in the national innovation formula. Most of the interviewees argue that while other factors in the innovation ecosystem (such as Technology and Venture Funding Entities), which influence the level of innovation are also found in other innovation ecologies, the special culture in Israel is a differentiating factor and the underlying reason for the success of Israeli innovation. The high ranking the interviews gave the contribution of Culture to the emergence of innovation in Israel and the homogeneity of their responses indicate the strength of their perceptions of the contribution of Culture and its centrality to the emergence of innovation in Israel.

Regarding Technology, no gap was found with the research literature. Most of the interviewees in this study reported this factor as being significant to the emergence of innovation in Israel.

6 CONCLUSIONS

The findings of the study demonstrate that there are five key factors in the Israeli innovation ecosystem. They are Government and Public Agencies, Academia and Research Institutes, Venture Funding Entities, Technology and Culture. However, it was found that while there is correspondence with the international research literature regarding the factors themselves, there are evidently gaps between countries with respect to the relative contributions of the various factors.

The study found that in certain fields there are gaps between the evaluation of the contribution of these factors to the emergence of innovation as documented in the literature and the evaluation of the interviewees in this study of their contribution to the emergence of innovation in Israel today. This is particularly salient in the rating and evaluation of the contribution of Government and Public Agencies, Academia and Research Institutes, and Venture Funding Entities.

According to the interviewees in this study, we can see that the ranking of the main factors in the innovation ecosystem was based on how they distinguished between the contribution, role and assistance of these factors to the emergence of innovation in the early stages of development of the ecosystem and the contribution currently required to maintain the Israeli innovation ecosystem dynamic, competitive and sustainable. For example, policy measures that were found effective in the early development stages of the innovation ecosystem were perceived by the interviewees as insufficient to enhance innovation today, when the Israeli innovation ecosystem is mature and developed. We maintain that the dynamic nature of the innovation ecosystem shows that in order to enhance national innovation, the performance of the players in the innovation ecosystem must constantly be adapted to the innovation ecosystem's development stage. These findings provide insight into the evolutionary nature of the innovation ecosystem, and should be examined in a follow-up study.

This study focused on examining the aspect of the "factors" in the innovation ecosystem and their relative importance. However, it should be recalled that these factors (both at the level of the firm and the entire economy) are less effective as innovation agents when they work in isolation. They contribute to promoting innovation because they are connected in a manner that facilitates the flow of know-how, capital and people. Therefore, a follow-up study should examine the aspect of

coordination and connectivity between the factors in the innovation ecosystem, which were identified in this study, while relating to the aspect of connectivity during the various stages of development of the innovation ecosystem.

REFERENCES

[1] Ministry of Economy, State of Israel, "Why Israel?," 11 2 2014. [Online]. Available: http://www.investinisrael.gov.il/NR/exeres/C901DB9C-83EE-4937-8CAD-78D15B92A55B.htm. [Accessed 25 5 2015].

[2] S. Durst and P. Poutanen, "Success factors of innovation ecosystems: A literature review," in *CO-CREATE 2013: The Boundary-Crossing Conference on Co-Design in Innovation*, 2013.

[3] B. Hannon, "The use of analogy in biology and economics: From biology to economics, and back," *Structural Change and Economic Dynamics,* pp. 471-488, 1997.

[4] R. Lewin, Complexity: Life at the Edge of Chaos, University of Chicago Press, 1999.

[5] B. Mercan and D. Göktaş, "Components of Innovation Ecosystems: A Cross-Country Study," *International Research Journal of Finance and Economics,* pp. 102-112, 2011.

[6] S. Metcalfe and R. Ramlogan, "Innovation systems and the competitive process in developing economies," *The Quarterly Review of Economics and Finance,* p. 433–446, 2008.

[7] A. Frenkel, S. Meital and E. Leck, "Like Some, Like All, Like None: A Comparison of Five National Innovation Ecosystems, With Emphasis on Markets & Demand," Samuel Neaman Institute, Haifa, 2012.

[8] M. Mazzucato, The Entrepreneurial State, London: Demos, 2011.

[9] J. Fagerberg, "Innovation: A guide to the literature," in *The Oxford Handbook of Innovation*, J. Fagerberg, D. C. Mowery and R. R. Nelson, Eds., New York, Oxford University Press, 2006, pp. 1-26.

[10] Y. Motoyama and J. Bell-Masterson, "Beyond Metropolitan Startup Rates: Regional Factors Associated with Startup Growth," Ewing Marion Kauffman Foundation, 2014.

[11] V. Wadhwa, A. Saxenian and D. Siciliano, "America's New Immigrant Entrepreneurs: Then and Now," Ewing Marion Kauffman Foundation, KANSAS CITY, 2012.

[12] Edelman Berland, "GE Global Innovation Barometer 2013 Results – Focus Israel," Daniel J Edelman Inc., Jerusalem, 2013.

[13] A. Frenkel and S. Maital, "Critical Integrative Review of the Literature on Demand-Side and Supply-Side Innovation," Samuel Neaman Institute in the context of the 7th Framework project, PICK-ME: Policy Incentives for Creation of Knowledge, 2012.

[14] L. Georghiou, J. Edler, E. Uyarra and J. Yeow, "Policy instruments for public procurement of innovation: Choice, design and assessment," *Technological Forecasting and Social Change,* vol. 86, pp. 1-12, 2014.

[15] A. Frenkel, S. Meital , E. Leck, D. Getz and V. Segal , "Towards Mapping National Innovation Ecosystems, Israel's Innovation Ecosystems," Samuel Neeman Institute, Haifa, 2011.

[16] G. Avnimelech and M. Teubal, "Evolutionary Innovation and High Tech Policy: What Can We Learn From Israel's Targeting of Venture Capital?," Samuel Neaman Institute for Advanced Studies in Science and Technology, Haifa, 2005.

[17] D. Schwartz and R. Bar-El, "Venture Investments in Israel – A Regional Perspective," *European Planning Studies,* vol. 15, no. 5, pp. 623-644, 2007.

[18] G. Avnimelech, D. Schwartz and M. Teubal, "Entrepreneurial High-Tech Cluster Development," in *Handbook of Research on Innovation and Clusters: Cases and Policies*, C. Karlsson, Ed., Edward Elgar, 2008, pp. 124-148.

[19] J. Bercovitz and M. Feldmann, "Entprepreneurial Universities and Technology Transfer: A Conceptual Framework for Understanding Knowledge-Based Economic Development," *Journal of Technology Transfer, 31,* pp. 175-188, 2006.

[20] D. C. Mowery and S. Shane, "Introduction to the Special Issue on University Entrepreneurship and Technology Transfer," *Management Science, 48 (1),* pp. v-ix, 2002.

[21] H. Etzkowitz and L. Leydesdorff, "The dynamics of innovation: from National Systems and "Mode 2" to a TripleHelix of university–industry–government relations," *Research Policy,* pp. 109-123, 2000.

[22] R. Miller and M. Cote, Growing the Next Silicon Valley: A Guide for Successful Regional Planning, Lexington Books, 1987.

[23] E. Mansfield, "Academic research and industrial innovation," *Research Policy,* pp. 1-12, 1991.

[24] Y.-S. Su, E. W. K. Tsang and M. W. Peng, "How do internal capabilities and external partnership affect innovativeness?," *ASIA PACIFIC JOURNAL OF MANAGEMENT,* p. 309–331, 2009.

[25] H. Etzkowitz, "Innovation in Innovation: The Triple Helix of University-Industry-Government Relations," *Social Science Information,* pp. 293-337, 2003.

[26] R. G. King and R. Levine, "Finance, entrepreneurship, and growth," *Journal of Monetary Economics 32,* pp. 513-542, 1993.

[27] World Economic Forum, "The Global Competitiveness Report 2013–2014," World Economic Forum, Geneva, 2013.

[28] J. A. Schumpeter, The Theory of Economic Development, Cambridge: Harvard University Press, 1934.

[29] T. J. Chemmanur, K. Krishnan and D. K. Nandy, "How Does Venture Capital Financing Improve Efficiency in Private Firms? A Look Beneath the Surface," *The Review of Financial Studies,* pp. 4038-4090, 2011.
[30] T. J. Chemmanur and P. Fulghieri, "Entrepreneurial Finance and Innovation: An Introduction and Agenda for Future Research," *The Review of Financial Studies,* pp. 1-20, 2014.
[31] European Union, "Innovation Union Scoreboard 2011," European Union, Brussels, 2012.
[32] S. Shane, "Cultural influences on national rates of innovation," *Journal of Business Venturing,* p. 59–73, 1993.
[33] L. K. Williams and S. J. McGuire, "Economic creativity and innovation implementation:the entrepreneurial drivers of growth? Evidencefrom 63 countries," *Small Business Economics,* pp. 391-412, 2010.
[34] A. Kaasa and M. Vadi, "How does culture contribute to innovation? Evidence from European countries," Tartu University Press, 2008.
[35] A. Saxenian, Regional Advantage: Culture and Competition in Silicon Valley and Route 128, Harvard University Press, 1996.
[36] V. Wadhwa, "Silicon Valley Can't Be Copied," 3 July 2013.
[Online]. Available: http://www.technologyreview.com/news/516506/silicon-valley-cant-be-copied/. [Accessed 20 May 2014].
[37] Y. Dashti, D. Schwartz and A. M. Pines, "High Technology Entrepreneurs, their Social Networks and Success in Global Markets: The Case of Israelis in the US Market," *Current Topics in Management,* no. 13, pp. 131-144, 2008.
[38] M. P. Feldman, "The character of innovative places: entrepreneurial strategy, economic development, and prosperity," *Small Business Economics,* vol. 43, no. 1, pp. 9-20, June 2014.
[39] R. Capello and A. Faggian, "Collective Learning and Relational Capital in Local Innovation Processes," *Regional Studies,* vol. 39, no. 1, pp. 75-87, 2005.
[40] Trigger Foresight, "E-NNOVATE Israel," Deloitte Brightman Almagor Zohar, Tel Aviv, 2013.
[41] E. Rogers, The Diffusion of Innovations, 5th ed., New York: The Free Press, 2003.
[42] Global Innovation Index, Accelerating Growth and Development, S. Dutta, Ed., Fontainebleau: INSEAD, 2011.
[43] D. Pilat, "The Economic Impacts of ICT – What Have We Learned Thus Far?," OECD, MANNHEIM, 2004.
[44] T. Clayton, C. Criscuolo, P. Goodridge and K. Waldron, "ENTERPRISE E-COMMERCE: MEASUREMENT AND IMPACT," in *The Economic Impact of ICT - Measurement, Evidence and Implications*, Paris, OECD, 2004, pp. 241-260.
[45] A. Sharma, "Integration of ICT in Teacher Education," *International Journal of Innovation and Scientific Research,* pp. 354-356, 2014.
[46] D. Senor and S. Singer, Start-Up Nation, New York: Grand Centeral Publishing, 2009.