ECONOMIC MIRACLES: VALUABLE ECONOMIC LESSONS FOR DEVELOPING NATIONS

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Abstract

This article, a literature review of Israel`s economic miracles, examines the secrets behind the transformation of Israel, a Start-up Nation slightly smaller than New Jersey or Wales born in 1948 with a population of around seven million, to become an Innovation Nation with more companies listed on the National Association of Securities Dealers Automated Quotations (NASDAQ) outside the United States of America. The article further examines the unique conditions existing in Israel which are luring technology companies and global investors. On the whole, it was established that Israel has managed to achieve economic development through its innovativeness that has come as a result of many factors some of which are discussed in this article. The author broadens the context of his conclusions by taking into consideration some of the concluding remarks by Israel `s Prime Minister Benjamin Netanyahu`s 2014, Davos World Economic Forum address. This article will go a long way in influencing government policy implementation. This article has therefore business and academic value.

Keywords: Israel, Economic Miracles, Economic Lessons, Developing Nations, Innovation, Start-ups

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1. Introduction

Israel which is often called the Start-Up Nation has of recent been called the Innovation Nation (Netanyahu, 2014). Netanyahu (2014) states that, the future now belongs to those who innovate. The Prime Minister further states that, those who do not innovate, whether in companies or in countries, will fall behind. Innovation has become the only way to consistently add value to products and services in an increasingly competitive global economy. Israel has become a global center for innovation, that is, a center for science and technology, and an indispensable ingredient of entrepreneurship (Netanyahu, 2014). Israel has become a strong and diverse economy, with exports contributing up to 34% of gross domestic product (GDP). Leading exports include cut diamonds, pharmaceuticals and high-technology and agricultural equipment. The country has become very competitive, ranking 27 out of 148 in The World Economic Forum's global competitiveness index, ahead of countries such as Ireland, Spain, and China (The World Economic Forum, 2014). It is well known that Israel has more start-ups per capita than any other nation; what is less known is that it has more engineers, scientists and technicians per capita than any other country. It ranks high for quality of scientific research institutions and innovation (The World Economic Forum (2014) ranked it 1st and 3rd, respectively, out of 148 countries).

Israel is a global leader in research and development (R&D), and it is this strength that has attracted many of the world's major international high-technology firms for decades. Intel famously innovated the Intel 8088 microchip in their Haifa plant in the 1970s, and their chip R&D centers have driven some of the companies most successful products ever since. But Intel is just the tip of the iceberg; there are many other companies that have set up shop or established R&D activities in Israel to take advantage of the highly educated workforce. Some of these companies include: Microsoft, Google, Oracle, IBM, Samsung, Yahoo, Apple, Facebook, Cisco, HP, Dell, SanDisk, Alcatel Lucent, General Motors, and SAP (IMF, 2014).

The main economic development indicator is the GDP – the net value of the goods and services produced by economic units in Israel. GDP is defined as the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products (The World Bank, 2015). It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources (The World Bank, 2015). The change in the GDP at constant prices reflects the economic growth along the years. The economy returned to a rapid rate of growth (8.9%) in 2000, which was a period of rapid growth particularly in the high-technology being one of the stronger sectors of Israel's economy, but slowed down beginning of October 2000 due to security incidents (Nathanson, 2011). The years 2001 and 2002 were a period of recession, due to the impact of the Second Intifada, and the GDP decreased by 0.1%, the lowest rate of growth since the founding of the State. In 2003 there was some recovery, and the GDP rose to 1.1%. The period of 2004–2007 was characterized by relatively

rapid growth, at a rate of 5.4% on average per year. The growth originated mainly from an acceleration of international trade and a relatively quiet period in security concerns, with the exception of the Second Lebanon War in July-August 2006. After a decrease in the rate of growth to 1.9% in 2009, mainly due to the worldwide economic crisis, there was recovery in 2010 and 2011, and the GDP increased by 5.7% and 4.1%, respectively. Israel was one of the rare countries that posted small growth during the global financial crisis of 2009. By comparison, the GDP in BRICS[28] countries increased by an average of 7.2% in 2010, and by 5.5% in 2011. GDP per capita is gross domestic product divided by midyear population. In 2014 the GDP per capita amounted to USD 37, 032 increasing from USD20, 902 in 2000. In 2014 it increased by 0.8%, following an increase of 3.8% in 2010. Significant increases were recorded in 2006 (3.9%), 2007 (4.4%) and 2010 (3.8%) (See Table 1 in appendix). Figure 5 and Figure 6 in the appendix graphically depicts the developments in Israel`s GDP growth and GDP per capita respectively over the period 2000 to 2014 in comparison with the BRICS countries.

Inflation as measured by the consumer price index (CPI) reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly (The World Bank, 2015). Figure 7 and Table 1 depicts how Israel has managed to control its annual inflation below 5% from 2000 to 2014 with the exception of 2002 in which it recorded 5.7%. Israel has performed well during this period in comparison with the BRICS countries.

Analyzing the sources of GDP, Nathanson (2011) states that, the main sector driving the Israel's growth is the services sector. Banking and finance, trade and commerce, transport and communications, government-supplied and personal services, public and private education, and state of the art health care comprise by far the greater part of GDP during the recent decades. From this standpoint, Israel economy has all the characteristics of a developed, post-industrial country, which enjoys highly skilled human capital involved in knowledge intensive production as opposed to a low-skilled labor-intensive economy with industrial focus (Nathanson, 2011).

Figure 8 to 11 and table 1 in the appendix provides some insights on how Israel has performed in areas such as ICT service and goods exports, new business density, that is, new registrations per 1000 people ages between 15 and 64, and the number of start-up procedures to register a business in comparison with the BRICS countries.

Given all these mind boggling economic developments, the question that still remains unanswered in many people`s minds up to now is, how can a small nation like Israel born in 1948 and involved in a number of wars has managed to achieve economic development. This article tries to provide an insight of Israel`s economic development as well as unveiling some of the valuable lessons that other countries, especially developing countries can learn. The article employed a literature review methodology of related journal articles and other publications in providing some of the insights behind the success stories of Israel`s economic growth and its attractiveness to investors.

2. Valuable economic lessons for developing nations

2.1 Sharing the risk

The Office of the Chief Scientist (OCS) in the Israeli Ministry of Economy is the government entity in charge of the execution of government policy for support of industrial R&D. The goal of the OCS is to assist in the development of technology in Israel as a means of fostering economic growth, encouraging technological innovation and entrepreneurship, leveraging Israel's scientific potential, enhancing the knowledge base of industry in Israel, stimulating high value-added R&D and encouraging R&D collaboration both nationally and internationally. A variety of ongoing support programs developed and offered by the OCS play a major role in enabling Israel to be a key center for high-technology entrepreneurship (Senor and Singer, 2009).

The OCS within its framework of the Law for the Encouragement of Industrial R&D, implements government policy regarding support of industrial R&D. This has helped enhancing the knowledge base of Israel's high-technology industries. The Israeli government shares in the risks of very early stage ideas, which would find it almost impossible to attract investment. By supporting industrial R&D, the OCS encourages entrepreneurs in high-technology start-up companies; leverages Israel's highly capable scientific and technological labor force, facilitates the academic industrial interface for the transfer of scientific know-how and technology and stimulates cooperation in R&D at national and international levels. Grants of up to 50% of R&D expenditures are given, with royalties of 3% to 5% of sales to be repaid if the project generates commercial income. On average over half of the Fund's budget is recovered from royalty repayments from successful projects, and this is less than 5% of the overall revenues generated for the economy. The success of government R&D policy can be seen in a number of ways. On a quantitative basis, Saul Lach of the Hebrew University in Jerusalem has demonstrated that the return to the economy of state investment in high-tech ranges from 473% to more than 1,000%.[29] More broadly, the government achieved its goal of building a robust high-tech sector. From a small base even as late as 1993, there are now approximately 4,000 high-tech companies, one of the highest concentrations of such firms outside of Silicon Valley (Berry and Grayeff,

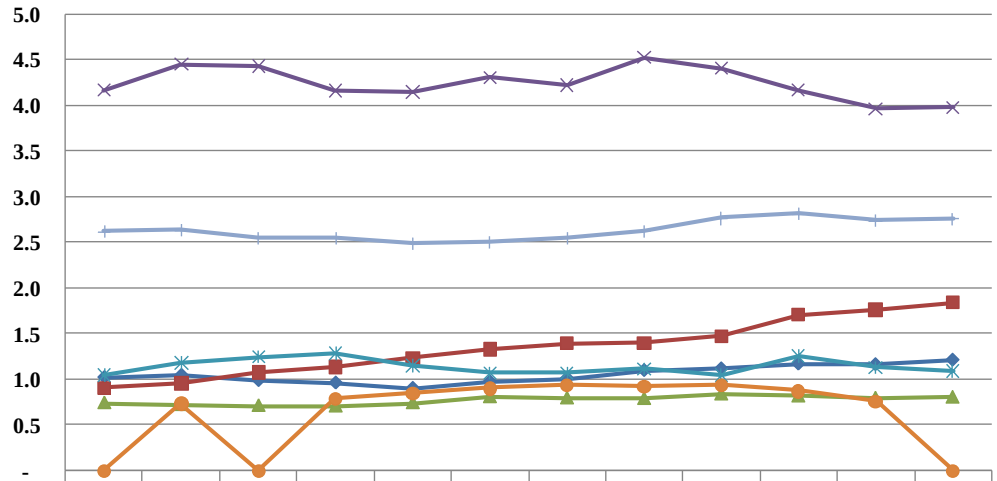
[28] BRICS –Brazil, Russia, India, China and South Africa

[29] The research was conducted by the research firm Applied Economics (http://www.applied. co.il) with Saul Lach's academic supervision.

2009). These companies employ almost 250,000 staff, while the segment's share of business sector employment was around 9% in 2007 (Berry and Grayeff, 2009).

There are many success stories that are as a result of Israeli government R&D policy. Figure 1 below shows Israel`s R&D expenditure as a percentage of GDP in comparison with the BRICS countries as well as U.S.A. from 2000 to 2011.

Figure 1. Research and development expenditure (% of GDP)



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Brazil	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.1	1.1	1.2	1.2	1.2
China	0.9	1.0	1.1	1.1	1.2	1.3	1.4	1.4	1.5	1.7	1.8	1.8
India	0.7	0.7	0.7	0.7	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Israel	4.2	4.5	4.4	4.2	4.1	4.3	4.2	4.5	4.4	4.2	4.0	4.0
Russian Federation	1.0	1.2	1.2	1.3	1.2	1.1	1.1	1.1	1.0	1.3	1.1	1.1
SA	-	0.7	-	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.8	-
USA	2.6	2.6	2.5	2.6	2.5	2.5	2.5	2.6	2.8	2.8	2.7	2.8

Source: Based on the World Bank (2015) World Development Indicators data

The World Bank (2015) defines R&D expenditures as current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture, and society, and the use of knowledge for new applications. R&D covers basic research, applied research, and experimental development (The World Bank, 2015). According to Nathanson (2011), Israel currently has the world's highest rate of R&D investment as percent of GDP [see Figure 1 above] (4.5%; Sweden is next with 3.6%, OECD average is 1.8%). This is due to the central role the technology sector plays in the services industry.

2.2 Israelis and the Talmud

Major General Farkash admitted that, it was not just the military but Israel's entire society and history that were anti-hierarchical and open to questioning (Senor and Singer, 2009). According to Major general Farkash, the Jewish religion is an open book. By "open book" he was referring to was the Talmud [see Maune, 2015 for a detailed description of what the Talmud is]—a dense recording of centuries of rabbinic debates over how to interpret the Bible and obey its laws—and the corresponding attitude of questioning was built into Jewish religion, as well as into the national ethos of Israel. Oz[30] cited in Senor and Singer (2009) stated that, Judaism and Israel have always cultivated "a culture of doubt and argument, an open-ended game of interpretations, counter-interpretations, reinterpretations, opposing interpretations. From the very beginning of the existence of the Jewish civilization, it was recognized by its argumentativeness." To add on to that, Unterman (1971) states, whoever has not observed two rabbis or scholars conducting a discussion on some subject never saw a mental game between two intellectual-artists played on the highest logical level. States sprang up and States vanished but the Jew has always preserved his Talmud and from it drew the strength to overcome all the tragedies of his history (Unterman, 1971 cited in Maune, 2015). To Unterman (1971), the inner world of the Jew has always remained whole and untouched; no outside influence, no danger no whirlwind had sufficient power to destroy this world. The Talmud has always been a

[30] Amos Oz, speech at the Israeli Presidential Conference, Jerusalem, May 14, 2008.

book solely for scholars, savants, and researchers. The Talmud has had a significant part to the very life of the Jewish people. It embraces the creativeness of many hundreds of years. It is an efflorescence which has substantially helped to mold and form the Jews` very essence (Unterman, 1971). An idea supported by Brackman and Jaffe (2008) in their book the Jewish wisdom for business success.

Through the Talmud, the Bible became a practical religio-national guide to life, a life-giving lore which combines within itself God and man, heaven and earth, spirituality and materiality (Unterman, 1971). The Bible became an inseparable part of Jewish life. Religion was the great force able to sustain the Jew, and this was made possible because the Talmudic scholars took the long view to life. They virtually created the Jewish way of life, which sustained the integrity of the Jewish people. Again, Unterman (1971) states that, a people without a unique way of life is impossibility ethnically. Others might have territory and government. But when political independence is lost, the nation itself declines. This has not held true for the Jew, however. Unterman (1971) claims that, the Jews were a nation even before they had a country and they have remained a nation even when they lost their country. In the very center of the Jewish culture is the Bible, which has had the greatest influence on the political and intellectual development of the entire world. The Talmud is the living Jewish power in the process of creativity, the national laboratory in which the Jewish intellectual creation has taken shape. Unterman (1971) further claims that progress and civilization without moral, ethical, and spiritual development, are valueless and even harmful.

2.3 The Jewish propensity to learn

The Jewish people have continued to exist because of the fact that they have always been a people of students, of learners and of scholars. As soon as they finished studying one thing, they began all over again (Unterman, 1971). The folk saying "Repeat over and over again" reveals in a flash the entire Jewish world ethos, which is based upon learning. The Jews have, however, maintained their faith, their books and the people themselves. Unterman (1971) states that, only a people of scholars can conquer all its enemies. The greatest enemies of the Jewish people have disappeared from the face of the earth because they were readers and not learners, because they had no Torah (Unterman, 1971). An educated person is not one who has merely read many books superficially. To Unterman (1971) an educated person is one who has read and studied the same books over and over again. It is not the number of books that one has read which is the important thing, but the extent to which these books have entered his consciousness and become a part of him and he a part of them. This can only be achieved through deep study (Unterman, 1971). Jews celebrate the conclusion of studying a book and not reading because reading by itself means very little. The reason why a celebration is made at the conclusion of one`s study is starting all over again. The joy, according to Unterman (1971), consists not only in having achieved, but in beginning a new achievement, in beginning the study of the book all over again. A Jewish community glories not in its rich men nor in its high officials, but in those few individuals sitting around immersed in studying the Talmud. Unterman (1971) seems to have borrowed this idea from Teller (1966) who states that, social status was a major consideration [among the Jews], but the gauge was learning, not wealth. This is supported by the Jewish saying, "Sell all your possessions to marry the daughter of a scholar, or to marry your daughter to a scholar." St. Jerome (Hieronymus) reports that all Jewish homes had bulging bookcases. The Jewish elite knew Greek, Latin, and Persian, in addition to Hebrew and the Aramaic vernacular (Teller, 1966).

According to Unterman (1971), the Hebrew word for argument is "pilpul" and stems from the word for pepper. Indeed the Talmudic arguments are as pungent and strong as pepper. The chief method is to take a sentence or some subject, analyze it into its many parts, and then to compare these parts with other analogous sentences or subjects on the basis of language, content and logic. Thus the argument continues until the assertion is indisputably established. Such a method of argumentation does not admit of dealing with a subject in a dilettante or superficial manner. A subject must be thoroughly fathomed and plumbed. A good method if applied to government policy design and analysis. According to the Gemara, immediately after the death of Moses, Othniel ben Kenaz was able to establish by his keen argumentative powers, 1700 principles and regulations of the law of the Torah which had already been forgotten. This is one of the major strength behind Israel`s success. Its intellectual capacity is, compared to non in the world, built through keenness and erudition.

2.4 Israel`s national service policy

Senor and Singer (2009) state that about thirty nations have compulsory military service that lasts longer than eighteen months. Most of these countries are developing or non-democratic or both. Amongst the first-world countries, only three countries have such a lengthy period of military service: Israel, South Korea, and Singapore. Not surprisingly, all these three face long-standing existential threats or have fought wars for survival in recent memory.[31] Singaporean National Service was introduced in 1967. While students in other countries would be preoccupied with deciding which college to attend, Israelis would be weighing the merits of different military units (Senor

[31] CIA, "Field Listing—Military Service Age and Obligation,"*The 2008 World Factbook*.

and Singer, 2009). And just as students elsewhere would be thinking about what they need to do to get into the best schools, many Israelis would be positioning themselves to be recruited by the IDF's elite units, that is, the commando units of the navy, the paratroopers, the infantry brigades, and, the most selective of all, the Sayeret Matkal, the chief of staff's commando unit, Mamram (the IDF's computer systems division) and the Talpiot (a unit that combines technological training with exposure to all the top commando units' operations). While it is difficult to get into the top Israeli universities, the nation's equivalent of Harvard, Princeton, and Yale are the IDF's elite units. The unit in which an applicant served tells prospective employers what kind of selection process s/he navigated, the skills and the relevant experience s/he may already possess (Senor and Singer, 2009).

The IDF has a unit that takes the process of extreme selectivity and extensive training to an even higher level, especially in the realm of technological innovation. That unit is Talpiot. The name Talpiot comes from a verse in the Bible's Song of Songs that refers to a castle's turrets; the term connotes the pinnacle of achievement (Senor and Singer, 2009). Talpiot has the distinction of being both the most selective unit and the one that subjects its soldiers to the longest training course in the IDF. The program was the brainchild of Felix Dothan and Shaul Yatziv, both Hebrew University scientists (Senor and Singer, 2009). They came up with the idea following the debacle of the 1973 Yom Kippur War. The program takes a handful of Israel's most talented young people and gives them the most intensive technology training that the universities and the military offer.

Once admitted into the program, Talpiot cadets blaze through an accelerated university degree in math or physics while they are introduced to the technological needs of all IDF branches. The academic training they receive goes beyond what the typical university student would receive in Israel or anywhere else—they study more, in less time (Senor and Singer, 2009). They also go through basic training with the paratroopers. The idea is to give them an overview of all the major IDF branches so that they understand both the technology and military needs—and especially the connection between them. Providing the students with such a broad range of knowledge is to transform them into mission-oriented leaders and problem solvers. This is achieved by handing them mission after mission, with minimal guidance. Some assignments are as mundane as organizing a conference for their fellow cadets, which requires coordinating the speakers, facilities, transportation, and food. Others are as complicated as penetrating a telecommunications network of a live terrorist cell. But more typical is forcing the soldiers to find cross-disciplinary solutions to specific military problems.

The Talpiot program as a whole is under Mafat, the IDF's internal R&D arm, which is parallel to America's DARPA (the Defense Advanced Research Projects Agency) (Senor and Singer, 2009). However, though Talpiot training is optimized to maintain the IDF's technological edge, the same combination of leadership experience and technical knowledge is ideal for creating new companies. Although the program has produced only about 650 graduates in thirty years, they have become some of Israel's top academics and founders of the country's most successful companies. NICE Systems, the global corporation behind call-monitoring systems used by eighty-five of the Forbes 100 companies, was founded by a team of Talpions. Many of the Israeli technology companies traded on the NASDAQ were either founded by a Talpion or have alumni situated in key roles. Two thirds of Talpiot graduates who end up either in academia or in technology companies continue to make a tremendous contribution to the economy and society, thereby strengthening the country in different ways (Senor and Singer, 2009). Talpions may represent the elite of the elite in the Israeli military, but the underlying strategy behind the program's development—to provide broad and deep training in order to produce innovative, adaptive problem solving—is evident throughout much of the military and seems to be part of the Israeli ethos: to teach people how to be very good at a lot of things, rather than excellent at one thing.

Senor and Singer (2009) quote Shainberg as saying, "There is something about the deoxyribonucleic acid (DNA) of Israeli innovation that is unexplainable." To him this comes down to maturity. The reason being that nowhere else in the world do people have to work in a center of technology innovation and at the same time doing national service.[32] At eighteen, Israelis go into the army for a minimum of two to three years. If they don't reenlist, they typically enroll at a university. Shainberg argued that, there is a massive percentage of Israelis who go to university out of the army compared to anywhere else in the world[33]. The Organization for Economic Co-operation and Development (OECD) states that, 45% of Israelis are university-educated, which is among the highest percentages in the world (Senor and Singer, 2009). And in accordance to *IMD World Competitiveness Yearbook,*[34] Israel was ranked second among sixty developed nations on the criterion of whether "university education meets the needs of a competitive economy."

By the time students finish college, in their mid-twenties; some would already have graduate degrees, and a large number married. According to Shainberg, all this changes the mental ability of the individual. Innovation is all about finding ideas. Innovation often

[32] Interview with Gary Shainberg, Vice President for technology and innovation, British Telecom, August 2008 by Senor and Singer.

[33] Ibid.

[34] *IMD World Competitiveness Yearbook* (Lausanne, Switzerland: IMD, 2005).

depends on having a different perspective. Perspective comes from experience. Real experience also typically comes with age or maturity. But in Israel, you get experience, perspective, and maturity at a younger age, because the society jams so many transformative experiences into Israelis when they are barely out of high school a different thing with their American counterparts. Every moment has strategic importance. As Mark Gerson, an American entrepreneur who has invested in several Israeli start-ups described it, "When an Israeli man wants to date a woman, he asks her out that night. When an Israeli entrepreneur has a business idea, he will start it that week. The notion that one should accumulate credentials before launching a venture simply does not exist. This is actually good in business. Too much time can only teach one what can go wrong, not what could be transformative."[35]

The IDF also offers recruits another valuable experience: a unique space within Israeli society where young men and women work closely and intensely with peers from different cultural, socio-economic, and religious backgrounds. They would spend two to three years serving together full-time, and then spend another twenty-plus years of annual service in the reserves. So for combat soldiers, connections made in the army are constantly renewed through decades of reserve duty. Not surprisingly, many business connections are made during the long hours of operations, guard duty, and training.

Indeed, relationships developed during military service form another network in what is already a very small and interconnected country. Everybody knows everybody. Nobody can hide. There is a very high degree of transparency."[36]

The military gets one at a young age and teaches him/her that when one is in charge of something, s/he has the responsibility for everything that happens . . . and everything that does not happen. The phrase 'It was not my fault' does not exist in the military culture. No college experience disciplines one to think like that . . . with high stakes and intense pressure. Senor and Singer (2009) argue that the military is also much better than college for inculcating young leaders with a sense of what is called social range. The people one serves with come from all walks of life and learning how to deal with anybody—wherever they come from—is something that one can use to leverage in today`s business when dealing with my suppliers and customers.

According to Senor and Singer (2009), vets bring things to the table that their business peers could only dream about, including a sense of proportionality—what is truly a life-or-death situation and what is something less than that; what it takes to motivate a workforce; how to achieve consensus under duress; and a solid ethical base that has been tested in the crucible of combat. While Israeli businesses still look for private-sector experience, military service provides the critical standardized metric for employers—all of whom know what it means to be an officer or to have served in an elite unit.

2.5 Israel`s self appointed diplomats

Many Israeli entrepreneurs and executives have self appointed themselves diplomatic missions on behalf of the state. Many of Israel's globe-trotting businesspeople are not just technology evangelists but endeavor to "sell" the entire Israeli economy. Medved is one such example (Senor and Singer, 2009). Senor and Singer (2009) state that, regardless of what Medved is doing for his enterprises, he spends a lot of time preaching about the Israeli economy. On every trip abroad, Medved lugs a portable projector and laptop loaded with a memorable slide presentation chronicling the accomplishments of the Israeli technology scene. In speeches —and in conversations with anyone who will listen—Medved celebrates all the Israeli landmark "exits" in which companies were bought or went public, and catalogs dozens of "made in Israel" technologies. In his presentations he would say only half-jokingly that if Israel would follow the lead of "Intel Inside"— Intel's marketing campaign to highlight the ubiquity of its chips—with similar "Israel Inside" stickers, they would show up on almost everything people around the world touch, and he would tick off a litany of examples: from computers, to cell phones, to medical devices and miracle drugs, to Internet-based social networks, to cutting-edge sources of clean energy, to the food we eat, to the registers in the supermarkets in which we shop (Senor and Singer, 2009). Medved would then hints to the multinationals in the room that they are likely to be missing something if they have not already set up shop in Israel. Medved, like many of his colleagues in Israel, has taken on a role that, in any other country, would typically belong to the local chamber of commerce, minister of trade, or foreign secretary. Medved is in perpetual motion. He has given the presentation fifty times a year for the last fifteen years. All told, almost eight hundred times, at technology conferences and universities around the world, in over forty countries, and to scores of international dignitaries visiting Israel. According to Vieux[37] cited in Senor and Singer (2009), from nearly a million high-tech conferences he has been to on multiple continents, he has seen Israelis like Medved giving presentations all the time, alongside their peers from other countries. The others would make a pitch for their specific companies were as the Israelis would

[35] Interview with Mark Gerson, executive chairman, Gerson Lehrman Group, January 2009 by Senor and Singer.

[36] Interview with Yossi Vardi, angel investor, May 2008 by Senor and Singer.

[37] Information obtained through an interview with Alex Vieux, CEO of Red Herring magazine in May 2009 by Senor and Singer.

make a pitch for Israel. Like Medved, Vardi[38] is one of Israel's legendary business ambassadors.

2.6 Military expenditure and defense R&D

Peled (2001) states that when viewed in historical perspective, there can be little doubt that the defense sector in Israel had a fundamental impact on the development of the country's technological and industrial capabilities. For most of its first 50 years, Israel devoted a large share of its resources to defense purposes, putting a high priority on the development of modern armed forces with sophisticated military technologies and equipment, and on the ability to develop and supply these capabilities by its own means (Peled, 2001). Derived demand from this buildup for highly skilled workers, scientists and engineers affected public resources allocated to universities and research institutions, and accordingly the directions that these institutions emphasized as they expanded (Peled, 2001). According to Lifshitz (2000), Israel has today a concentration of scientists and engineers in its work force which is among the highest in the world, and a rate of high-tech start-ups which is high among industrialized countries even in absolute terms. Five Israeli companies appear in the list of the 100 biggest defense companies in the world, (Israeli Aircraft Industries, RAFAEL, Koor Industries, Tadiran, and Elbit Systems). The defense industry accounts for about 25% of industrial output in Israel, and about 20% of total employment in the industrial sector (Lifshitz, 2000). Furthermore, Lifshitz (2000) argues that defense industries in Israel led its industrial sector in R&D and high-tech intensity through most of the first four decades of its existence. About half the scientists and engineers employed in the industrial sector worked in defense industries (Lifshitz, 2000). Figure 2 below shows Israel`s military expenditure[39] as a percentage of GDP in comparison with the BRICS countries.

By looking at military spending as providing public good, allowed researchers to consider a wide range of interactions between economic performance and military spending (Peled, 2001). Deger and Sen (1995) provide several channels through which military expenditures affect the economy. The following channels were considered: (1) enhanced security, which increases social welfare; (2) defense allocations can increase total factor productivity through: training of high skilled workforce, creating infrastructure, increasing technical progress via R&D, and encouraging spin-offs; (3) government budget constraint and crowding-out of private investments; (4) a trade-off between different kinds of public goods to be provided by the government, (for example, education versus military security); (5) the demand for high skilled workers "crowds out" skilled workers from civilian sectors, and accordingly may decrease the marginal product of capital in those sectors.

Having no natural resources, the "human capital" of the workforce in Israel is its most valuable economic resource, and the only one that can be further developed to support a sustained economic growth (Peled, 2001). Peled (2001) further claims that, the composition of the Israeli workforce has a relatively high share of hi-tech workers, engineers, and scientists, and is less costly than the workforce in other industrialized countries.[40] The problem-solving and improvising nature of addressing urgent military needs has produced a workforce with valuable qualifications for the rapidly changing high-tech civilian world. Dvir and Tishler (1999) claim that, a disproportionate large number of "graduates" of elite technological units in the IDF have been recruited by and/or initiated many technological start-ups in Israel. Dvir and Tishler (1999) emphasize the high proportion of successful high-tech entrepreneurs in Israel to prior experience gained from service in elite units of the IDF.

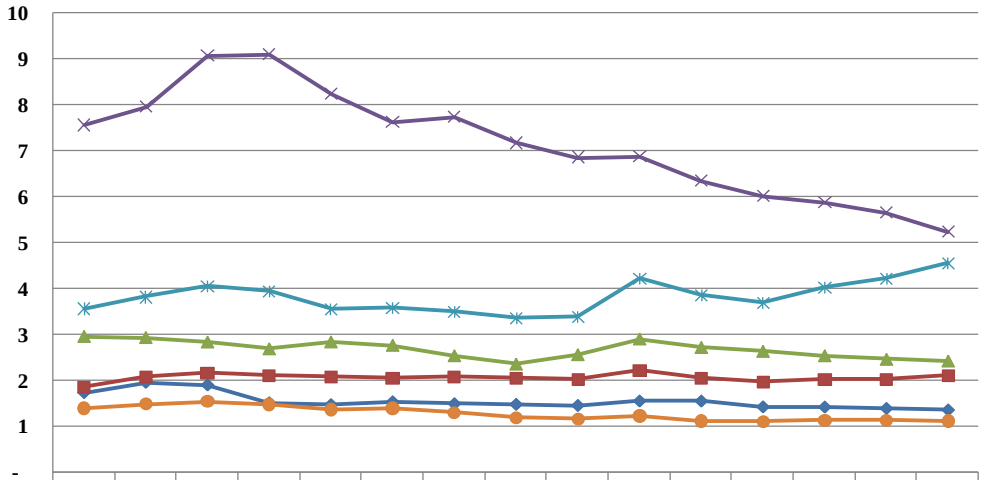
The existence of strong ties between defense-related R&D and universities in Israel, create a unique opportunity for enhancing the links between technological education and research at Israeli universities and R&D for generic technologies with military applications (Peled, 2001).

[38] Yossi Vardi is the godfather of dozens of Internet start-ups and one of the champion networkers in the wired world.

[39] Military expenditures data from Stockholm International Peace Research Institute (SIPRI) are derived from the NATO definition, which includes all current and capital expenditures on the armed forces, including peacekeeping forces; defense ministries and other government agencies engaged in defense projects; paramilitary forces, if these are judged to be trained and equipped for military operations; and military space activities. Such expenditures include military and civil personnel, including retirement pensions of military personnel and social services for personnel; operation and maintenance; procurement; military research and development; and military aid (in the military expenditures of the donor country). Excluded are civil defense and current expenditures for previous military activities, such as for veterans' benefits, demobilization, conversion, and destruction of weapons. This definition cannot be applied for all countries, however, since that would require much more detailed information than is available about what is included in military budgets and off-budget military expenditure items. (For example, military budgets might or might not cover civil defense, reserves and auxiliary forces, police and paramilitary forces, dual-purpose forces such as military and civilian police, military grants in kind, pensions for military personnel, and social security contributions paid by one part of government to another) (http://portal.sipri.org/publications/pages/transfer/splash).

[40] Out of every 10000 workers in Israel, 135 are scientists and engineers, vs. 85 in the US. Out of every 1000 workers in Israel, 9 are employed in R&D, almost twice as many as R&D workforce concentration in Japan and the US, (Hi-Technion, Technion Alumni Association, Vol. 17, December 2000, p. 67).

Figure 2. Israel & BRICS Military expenditure (% of GDP)



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Brazil	2	2	2	2	1	2	1	1	1	2	2	1	1	1	1
China	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
India	3	3	3	3	3	3	3	2	3	3	3	3	3	2	2
Israel	8	8	9	9	8	8	8	7	7	7	6	6	6	6	5
Russian Federation	4	4	4	4	4	4	3	3	3	4	4	4	4	4	5
SA	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1

Source: Based on the World Bank (2015) World Development Indicators data

2.7 Ministry of Defense as breeding grounds for hi-tech workforce and start-ups

R&D performed on behalf of the IDF and MOD, within and outside the armed forces, has provided breeding grounds for highly skilled and entrepreneurial workers, capable of creating and working in successful hi-tech companies (Peled, 2001). It is not surprising that multitasking, like many other advantages Israeli technologists seem to have, is fostered by the IDF (Nathanson, 2011). Nathanson (2011) further states that, IDF's leading R&D departments have served as breeding grounds for thousands of top-notch high-technology personnel, many of whom have applied what they learned with respect to military technology in commercial environment.

According to fighter pilot Yuval Dotan cited in Senor and Singer (2009), there is a distinct bias against specialization in the Israeli military. In the Israeli system, almost every aircraft is a jack-of-all-trades. The following are some of the technological spillovers from MOD to business as cited in Senor and Singer (2009); Given Imaging, a start-up that was built around a pill that transmit images from inside intestines using optics technology taken from a missile's nose cone. This was developed by Gavriel Iddan who used to be a rocket scientist for Rafael, a company that is one of the principal weapons developers for the IDF. He specialized in the sophisticated electro-optical devices that allow missiles to "see" their target. Rockets might not be the first place one would look for medical technology, but Iddan had a novel idea: he would adapt the newest miniaturization technology used in missiles to develop a camera within a pill that could transmit pictures from inside the human body. In 2001, Given Imaging became the first company in the world to go public on Wall Street after the 9/11 attacks. By 2004, six years after its founding, Given Imaging had sold 100,000 PillCams. In early 2007, the company hit the 500,000 PillCams mark, and by the end of 2007 it had sold almost 700,000. Today, the latest generation of PillCams painlessly transmit eighteen photographs per second, for hours, from deep within the intestines of a patient. The video produced can be viewed by a doctor in real time, in the same room or across the globe. The market remains large and has attracted major competitors; the camera giant Olympus now makes its own camera in a pill. The story of Given Imaging is not just one of technology transfer from the military to the civilian sectors, or of an entrepreneur emerging from a major defense technology company. It is an example of a technology mashup,[41] of someone combining not only the disparate fields of missiles and medicine but integrating a staggering array of technologies—from optics, to electronics, to batteries, to wireless data transmission, to software, in order to help doctors analyze what they are seeing. These types of mashups

[41] Mashup is the term in the United States for crossover. Originally referring to the merging of two or more songs into one, it has also come to designate digital and video combinations, as well as a Web application that meshes data from other sites—such as HousingMaps.com, which graphically displays craigslist rentals postings on Google Maps. An even more powerful mashup is when innovation is born from a combination of radically different technologies and disciplines.

are the holy grail of technological innovation. In fact, a recent study by Tel Aviv University revealed that patents originating from Israel are distinguished globally for citing the highest number and most diverse set of precedent patents.[42]

Another such spillover company that has bridged the divide between the military and medicine, is Compugen, whose three founders—President Eli Mintz, chief technology officer Simchon Faigler, and software chief Amir Natan—met in the Israel Defense Forces` (IDF) elite Talpiot program. Another Talpiot alumnus at Compugen, Lior Ma'ayan, stated that twenty-five of the sixty mathematicians in the company joined through their network of army contacts. In the IDF, Mintz created algorithms for sifting through reams of intelligence data to find the nuggets that have been so critical to Israel's successes in hunting terrorist networks. When his wife, a Geneticist, described the problems they had in sifting through enormous collections of genetic data, Mintz thought he might have a better way to do it. Mintz and his partners were about to revolutionize the process of genetic sequencing. Merck bought Compugen's first sequencer in 1994, a year after the start-up was founded and long before the human genome had been successfully mapped. But this was just the beginning. In 2005, Compugen transformed its business model and moved into the drug discovery and development arena, and did so using techniques different from those that dominate the pharmaceutical industry. Combining mathematics, biology, computer science, and organic chemistry, Compugen has been pioneering what it calls "predictive" drug development. Rather than testing thousands of compounds, hoping to hit upon something that "works," Compugen's strategy was to begin at the genetic level and develop drugs based on how genes express themselves through the production of proteins. A major aspect of Compugen's approach was its unusual combination of "dry" (theoretical) and "wet" (biological) labs. "Imagine working with Big Pharma overseas or in another part of the country," Alon Amit, Compugen's VP for technology, explained. "The back and forth that you can expect is a lot slower than if you have the biologists and mathematicians literally on the same floor discussing what to test, how to test, and inform the models."[43]

Again another spillover, mashup-based company is Aespironics, which has developed an inhaler the size and shape of a credit card that includes a breath-powered wind turbine. The problem with many inhalers is that they are tricky and expensive to manufacture. A way was to be found to release the drug effectively through a wire mesh. In addition, this process was to be timed perfectly with the breath of the patient to maximize and regulate the drug's absorption in the lungs. Aespironics seems to have solved all these problems at once. Inside the "credit card" is a fanlike propeller that is powered by the flow of air when the patient inhales from the edge of the card. As the propeller turns, it brushes against a mesh with the drug on it, thereby knocking the drug off the mesh and into the air flow in a measured manner. Since the propeller works only when the user inhales, it automatically propels the drug into the patient's lungs. Putting this together required an unorthodox combination of engineering skills. In addition to experts on inhalers, Aespironics' team includes Dan Adler, whose specialty is designing gas turbines and jet engines. He was a professor at the Technion and at the U.S. Naval Graduate School and a consultant to such companies as General Dynamics, Pratt & Whitney, and McDonnell Douglas. Mixing missiles and pills, jets and inhalers may seem strange enough, but the true mashup champion may be Yossi Gross. Born in Israel and trained in aeronautical engineering at the Technion, Gross worked at Israel Aircraft Industries for seven years before leaving to pursue more entrepreneurial endeavors.

Some of Gross's companies combine such wildly diverse technologies that they border on science fiction. Beta-O2, for example, is a start-up working on an implantable "bioreactor" to replace the defective pancreas in diabetes patients. Diabetics suffer from a disorder that causes their beta cells to cease producing insulin. Transplanted beta cells could do the trick, but even if the body didn't reject them, they cannot survive without a supply of oxygen. Gross's solution was to create a self-contained micro-environment that includes oxygen producing algae from the geysers of Yellowstone Park. Since the algae need light to survive, a fiber-optic light source is included in the pacemaker-sized device. The beta cells consume oxygen and produce carbon dioxide; the algae does just the opposite, creating a self-contained miniature ecosystem. The whole bioreactor is designed to be implanted under the skin in a fifteen-minute outpatient procedure and replaced once a year. Combining geothermal algae, fiber optics, and beta cells to treat diabetes is typical of Gross's cross-technology approach.[44]

Another of his start-ups, Trans-Pharma Medical, combines two different innovations: using radio frequency (RF) pulses to create temporary micro-channels through the skin, and the first powder patch ever developed. It is a small device, Gross explains, "like a cell phone, that one applies to the skin for one second. It creates RF cell ablation, hundreds of micro-channels in the skin. Then a powder patch is applied on top, not a regular patch. Most patches out there are gel- or adhesive-based. The drug is then printed on the patch, and it is dry. When applying the patch to the skin, the interstitial fluid comes out slowly from the micro-channels and pulls the lyophilized [freeze-

[42] Manuel Trajtenberg and Gil Shiff, "Identification and Mobility of Israeli Patenting Inventors," Discussion Paper No. 5-2008, Pinchas Sapir Center for Development, Tel Aviv University, April 2008.

[43] John Russell, "Compugen Transforms Its Business," Bio-ITWorld .com, October 17, 2005, http://www.bio-itworld.com/issues/2005/oct/bus-compugen?page:int=-1

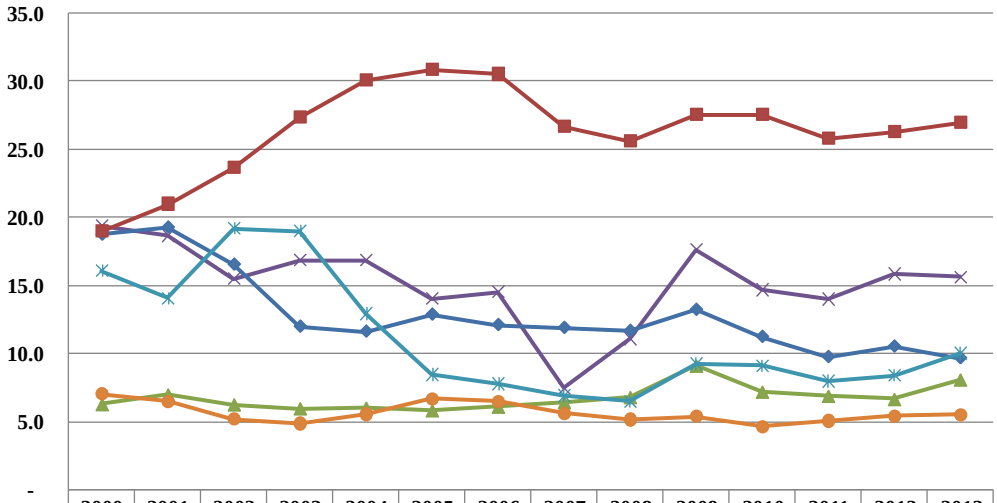
[44] Interview with Ruti Alon, partner, Pitango Venture Capital, and chairperson, boards of BioControl, BrainsGate, and TransPharma Medical, December 2008 by Senor and Singer.

dried] powder from the patch under the skin." Gross stated that this device solves one of the most intractable problems of drug delivery: how to get large molecules, such as proteins, through the outer layer of the skin without an injection. The first products will deliver human growth hormone and a drug for osteoporosis; patches to deliver insulin and other drugs, hormones, and molecules—most of them currently delivered by injections—are in the works.

The Israeli penchant for technological mashups is more than a curiosity; it is a cultural mark that lies at the heart of what makes Israel so innovative. It is a product of the multidisciplinary backgrounds that Israelis often obtain by combining their military and civilian experiences. But it is also a way of thinking that can be traced back to the study of the Talmud that produces particularly creative solutions and potentially opens up new industries and "disruptive" advances in technology. It is a form of free thinking that is hard to imagine in less free or more culturally rigid societies, including some that superficially seem to be on the cutting edge of commercial development (Senor and Singer, 2009).

Figure 3 below shows how Israel compares with the BRICS countries on High-technology exports from 2000 to 2013. The World Bank (2015) defines high-technology exports as products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery. From the graphical representation, Israel comes second after China in terms of high-technology exports expressed as a percentage of manufactured exports.

Figure 3. High-technology exports (% of manufactured exports)



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Israel	19.4	18.6	15.5	16.8	16.9	14.0	14.5	7.5	11.1	17.6	14.7	14.0	15.8	15.6
Brazil	18.7	19.2	16.5	12.0	11.6	12.8	12.1	11.9	11.6	13.2	11.2	9.7	10.5	9.6
China	19.0	21.0	23.7	27.4	30.1	30.8	30.5	26.7	25.6	27.5	27.5	25.8	26.3	27.0
India	6.3	7.0	6.2	5.9	6.0	5.8	6.1	6.4	6.8	9.1	7.2	6.9	6.6	8.1
Russian Federation	16.1	14.0	19.2	19.0	12.9	8.4	7.8	6.9	6.5	9.2	9.1	8.0	8.4	10.0
SA	7.0	6.5	5.2	4.8	5.5	6.7	6.5	5.6	5.1	5.4	4.6	5.0	5.4	5.5

Source: Based on the World Bank (2015) World Development Indicators data

2.8 Resourcefulness creates resources

Israel's founding fathers were concerned at the country's absence of natural resources. They need not have worried, for while the land lacked resources, the resourcefulness of the people more than compensated. In the State's formative years this resourcefulness was channeled into defense technologies to give the IDF the qualitative edge that would guarantee its existence.[45] Innovation made Israel a global leader in a range of military technologies, including unmanned aerial vehicles, missile-systems, night-vision, lasers, radar, intelligence systems, C4, military communications and homeland defense solutions.[46] Israel became one of the few countries to develop an independent space launch capability and satellite technology. Over the years, this know-how formed the basis for the development of the country's commercial high-technology sector.

Even the few natural resources that Israel does possess in the Dead Sea and the Negev – mainly

[45] Dr Eli Opper is the Chief Scientist of the Ministry of Industry, Trade and Labor since July 2002. From 2000- 2002 he was a venture partner at Giza Venture Capital and from 1973 until 2000 he was at RAFAEL, the Armament Development Authority. Dr Eli Opper has written Development and Future Prosperity: Innovation is the Essence of Israel's Growth, in Israeli Ingenuity: The Development of an Economic and Scientific Powerhouse, *From Modest Beginnings to a Vibrant State, ISRAEL AT 60.*

[46] Ibid.

phosphates, bromine and potash – have been transformed into annual exports of nearly USD4 billion in 2007 through innovative extraction technologies and the development of products requiring those minerals.[47] The most striking example of such innovation has been the ability to extract magnesium alloys from the Dead Sea in a joint venture between Israel Chemicals and Volkswagen, for use in vehicle and aircraft manufacturing.[48]

Moreover, many of the world's leading high-technology corporations have acquired Israeli firms – Cisco and Kodak have each purchased half a dozen Israeli companies, and have also opened R&D centers in Israel where they have been able to develop breakthrough technologies through taking advantage of the highly educated Israeli workforce (IMF, 2014). It was in Israel that Motorola developed its first cell-phones, that Intel produced its Pentium MMX Chip technology and that Microsoft put together much of its NT and XP operating systems.[49]

2.9 Incubation of innovative ideas

Israel is proud of its incubator program, a unique national network of 24 technological incubators, most of them in peripheral regions, which have since their inception in 1991 have nurtured over 1,000 earliest stage high-technology projects, of which 57% have attracted investments of over USD2 billion.[50] It has produced ideas like Protalix, a biotech company that produces recombinant therapeutic proteins that has raised over USD400 million in investment capital. Protalix would have remained an idea had the incubators not existed. While each incubator was initially set up as a non-profit venture, success has seen most of them become privatized, profitable entities owned by investors.[51]

The OCS also promotes cooperation between academia and industry through the MAGNET program, which establishes about 12 consortia annually to engage in generic R&D.[52] For example, consortia are currently active in the commercialization of stem cell therapy, Nano-size functional materials and advanced low-power high-end applications.

It is no coincidence that the military—particularly the elite units in the air force, infantry, intelligence, and information technology arenas—have served as incubators for thousands of Israeli high-technology start-ups. Other countries may generate them in small numbers, but the Israeli economy benefits from the phenomena of *rosh gadol*[53] thinking and critical reassessment, undergirded by a doctrine of experimentation, rather than standardization, wide enough to have a national and even a global impact.

2.10 The secret behind Israel's start-ups success

Vardi, widely known as the guru of early-stage Israeli high-tech companies, is an unconventional kind of investor (Senor and Singer, 2009). So it is not surprising that Vardi's explanation of why Israel is second only to Silicon Valley in the number of start-up companies it produces transcends the conventional wisdom. Vardi cited in Senor and Singer (2009) did not discounts the high level of scientific research at Israeli universities; the experience would be entrepreneurs gain by serving in super-secret IDF technology units, or the fact that technology is the driving force behind Israel's rapid economic growth. All these are important though there is another element which is part of Israel and that is its heritage that is normally not associated with high-technology. It is the capacity to take chances. That capacity was developed over two millennia of the Jewish Diaspora. As a consequence, the ability to adapt and innovate, to take chances, developed in the genetic pool of the people who are now Israelis. This innate ability to take risks is a special trait. In most cultures, risk-taking is treated in different ways. In Japan, losing face is a big issue. If one has a start-up and do not succeed, one lose face, and that is bad. In Israel, like in the Silicon Valley, it's acceptable to fail in a legitimate way. It is like mountain climbing, where people have to return to the base camp, regroup and then go back and try to reach the summit again. Conquest of a mountain is rare on the first attempt. Admitting failure is also important. The difference between a good investor and an amateur is how one handles failure. High-technology start-ups are very risky and very unclear. If people are not prepared to take risk then they will be no industry of start-ups.

2.11 Israel as a top destination for venture capitalists

Though today it is a pretty commonplace event—Europeans have invested hundreds of millions of Euros in Israeli companies—in 1995, for an Israeli start-up to be acquired by a European company was unheard of but, however, this was made possible thanks to the Israeli government program, the Yozma. According to the Israel Venture Association[54], there are now forty-five Israeli venture capital (VC) funds.

[47] Ibid.
[48] Ibid.
[49] Dr Eli Opper is the Chief Scientist of the Ministry of Industry, Trade and Labor since July 2002. From 2000- 2002 he was a venture partner at Giza Venture Capital and from 1973 until 2000 he was at RAFAEL, the Armament Development Authority. Dr Eli Opper has written Development and Future Prosperity: Innovation is the Essence of Israel's Growth, in Israeli Ingenuity: The Development of an Economic and Scientific Powerhouse, *From Modest Beginnings to a Vibrant State, ISRAEL AT 60.*
[50] Ibid.
[51] Ibid.
[52] Ibid.

[53] Rosh gadol means literally "big-head." Israelis rely on human ingenuity much more than structure, process and other components which create systemic scalability. Rosh gadol is basically the statement: You are better than the system; make it happen.
[54] Israel Venture Capital Association: www.iva.co.il

Over the period from 1992 to early 2009, there have been as many as 240 VCs in Israel, defined as companies both foreign and domestic investing in Israeli start-ups[55]. The Yozma funds created between 1992 and 1997 raised just over USD200 million with the help of government funding. Those funds were bought out or privatized within five years, and today they manage nearly USD3 billion of capital and support hundreds of new Israeli companies. VC was the match that sparked the fire (Senor and Singer, 2009).

Yozma was a program that the Israeli government set up in 1993 to build a VC industry from scratch, and within a few years, dozens of local firms had been established and hi-technology companies were routinely raising more than USD1 billion a year from domestic and foreign sources (Senor and Singer, 2009). In 2007, the total figure was USD1.76 billion,[56] which on an absolute basis is comparable with the United Kingdom, France and greater than Germany and on a per capita basis is comparable with the United States. Major foreign VCs that have set up branches in Israel, include: Sequoia Capital (the firm behind Google, Apple and many more), Benchmark and Greylock Partners, while numerous others have provided financing to Israeli firms[57]. What attracts venture money to Israel is, as was shown in a survey of U.S. VCs by Deloitte Touche Tohmatsu, the quality of the deal flow[58]. Israel is a seething hotbed of entrepreneurship and boasts 4,000 hi-tech companies, the highest concentration of such firms outside Silicon Valley. These businesses have pioneered disruptive and market changing technology that has had a global impact and earned billions of dollars in revenue. Scores of start-ups have carried out exits via initial public offerings on stock exchanges [see Israeli companies on the NASDAQ stock exchange in Figure 12 and Table 2 in the appendix] or by being acquired at significant values, often by the world's biggest multinationals.

The technological breakthroughs are made possible by a high-quality workforce educated at world-class institutions, the alumni of which found start-up companies in their thousands. Many of those who achieve success return to do it all over again, attracting VC funding all the more easily the next time around. None of this would be possible, though, without the government, which not only created Yozma but has also established numerous other initiatives to help start-ups support R&D and encourage investment in hi-tech firms. If it were purely about the technology, Israel would be an easy sell; some of the innovation is mind-blowing. However, while exciting technology is important, what also attracts VCs to Israel is the possibility of a successful exit. Israel has more companies listed on NASDAQ than any other country outside North America, and between 2004 and 2007, Israeli firms raised USD2.3 billion in IPOs on exchanges around the world[59]. Moreover, the market capitalizations of many listed businesses have become considerable (see Table 2 and Figure12 in the appendix).

In addition, many firms have been acquired in high profile transactions, and between 2004 and 2007, almost USD18 billion was spent on the purchase of Israeli hi-tech companies[60]. The most significant deals include HP's acquisition of IT optimization software firm Mercury Interactive for USD4.5 billion and SanDisk's buy of msystems, which invented the disk-on-key, for USD1.5 billion. It is worth noting that these deals were announced during Israel's war with Hezbollah in the summer of 2006, as was Warren Buffett's acquisition of Iscar Metalworking for USD4 billion, and are thus extraordinary testaments to how the world's top businessmen view investment in Israel despite the geo-political situation (see impact in Figure 4 below on Israel`s foreign direct investment (FDI) inflow in 2006) (Nathanson, 2011). Dozens of other multinational firms that have made acquisitions in Israel as well includes: Microsoft, Intel, IBM, Applied Materials, Siemens and Cisco Systems. Many of the giant corporations that have bought Israeli companies also have R&D facilities in the country, attracted, among other things, by a superior workforce (IMF, 2014). This is also a factor for VCs, because they base their investment decisions on the quality of a start-up's management and because they know that there is a large talent pool from which to recruit. Per capita, Israel is among the leading countries in the world for the number of engineers, PhDs, patents, scientific papers published and citizens with a tertiary education. According to Prime Minister Netanyahu (2014), Israel ranks highly for the quality of its research organizations, which include the Technion – Israel Institute of Technology, the Weizmann Institute, the Hebrew University and the Ben-Gurion University of the Negev[61].

The state not only set up the Yozma Program in 1993, it contributed USD100 million of funding and helped ensure its success by attracting foreign VCs to provide their capital and, just as importantly, their expertise. Although Yozma had a fixed life of seven years, the government was able to privatize its 40% holdings by 1997. Israel has also encouraged

[55] Dr Orna Berry has been a Venture Partner at Gemini Israel Funds, a Yozma fund created in 1993. One of Gemini's first investments was in Ornet Data Communications Technologies, a company that Dr Berry co-founded and which was sold to Siemens in November 1995 for USD32 million. After that, she served as the Chief Scientist of the Israeli government before joining Gemini. In January 2007, Dr Berry was elected as Chair of the Israel Venture Association, a post she still holds. Dr Berry has written Why Israel is a Top Destination for Venture Capitalists, in Israeli Ingenuity: The Development of an Economic and Scientific Powerhouse, *From Modest Beginnings to a Vibrant State, ISRAEL AT 60.*

[56] Israel Venture Capital (IVC) Research Center, "2007 Summary of Israeli High-Tech Company Capital Raising," (Tel Aviv, 2008).

[57] Dr Orna Berry.

[58] Deloitte Touche Tohmatsu, "Global Trends in Venture Capital, 2007 Survey,"Global Report.

[59] IVC Research Center

[60] Ibid.

[61] Dr Orna Berry

investment through regulatory changes, such as liberalizing foreign currency rules to ease capital raising in Israel and abroad, cutting tariff and non-tariff barriers, and reducing labor, capital income and other taxation. While Yozma and the regulatory changes have directly stimulated VC investment, the government's OCS indirectly encourages this type of financing by running programs designed to increase the chances of hi-tech companies succeeding. One of the most important initiatives is the Israel-US Bi-national Industrial Research & Development (BIRD) Foundation, which provides funding to joint projects between U.S. and Israeli companies. Since its inception in 1977, BIRD has invested over USD245 million in 740 projects that have produced sales of over USD8 billion. Israel has similar bi-lateral arrangements with several other countries as well and even signs agreements with multinational corporations whereby the OCS helps them identify Israeli companies with which they can carry out R&D and then provides the subsequent partnerships with financial assistance.

Aside from helping to generate revenue, these programs have enabled Israeli companies to learn valuable lessons while working with large corporations. Many of the factors that make Israel a top destination for venture investment form interlocking virtuous circles. For example, Israel produces great technology because it has great technologists, and this has attracted multinational corporations. These corporations help improve the quality of the technologists and their commercial abilities, whether as partners, employers or clients, and this contributes to the formation and/or success of start-ups. Some of these are bought by foreign firms, and the circle starts again. Financiers attracted to Israel by the initial potential of the outstanding technology and workforce continue investing in the country if they achieve good returns, such as through a sale to a major international buyer. This also brings in more investors and encourages the establishment of more start-ups, thereby increasing the opportunities for venture investors. Underpinning this whole construct is the government, which created the VC industry and has done much to help it succeed.

In most countries, FDI inflows entail a transfer of technology from overseas, which stimulates domestic investment and mitigates appreciation pressures on the exchange rate. By contrast, an important fraction of FDI flows into Israel have the same properties as portfolio investments: through start-up exits, which are recorded as inward FDI or exports of services,[62] foreigners acquire know-how and technology (IMF, 2014). About 50% of the stock and flow of inward FDI is accounted for by the ICT and high-technology manufacturing industries, where there are a large number of startups (IMF, 2014). The ICT sector represents 30% of exports, but it only contributes to 10% of the economy's gross value added (GVA) and to 6% of employment (IMF, 2014). Hence, to the extent that start-up exits contribute to the appreciation of the exchange rate, they undermine the competitiveness of more labor intensive-industries. This is evidenced by the declining market share of Israel's goods exports, compared with the increase in the share of services exports (IMF, 2014).

With a thriving high-technology sector, Israel draws a lot of FDI. Figure 4 below shows how Israel compares with the BRICS nations in terms of FDI[63], net inflows as a percentage of GDP from 2000 to 2012.

2.12 Israel`s international cooperation policy

2.12.1 Israel and overseas markets

In addition to what has been discussed, the OCS is responsible for signing agreements with other governments that support industrial R&D cooperation between Israeli industry and overseas industries. Through MATIMOP[64] – Israeli Industry Center for R&D has managed to set up bi-national funds with the United States, Canada, Britain, Singapore and Korea, and it is the only non-European country participating in the EU's Framework Programs for R&D[65]. These funds and other programs play an important role in opening up foreign markets for Israeli high-technology companies.

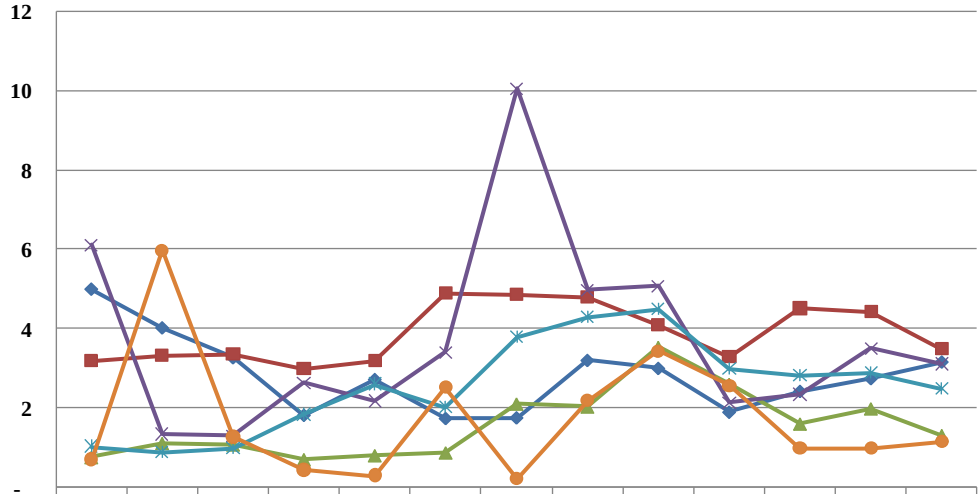
[62] Companies that are sold out are recorded as services exports, while equity investments that entail a transfer of ownership (or control) are recorded as FDI.

[63] Foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is divided by GDP.

[64] Israeli Industry center for R&D: www.matimop.org.il

[65] Dr Eli Opper is the Chief Scientist of the Ministry of Industry, Trade and Labor since July 2002. From 2000- 2002 he was a venture partner at Giza Venture Capital and from 1973 until 2000 he was at RAFAEL, the Armament Development Authority. Dr Eli Opper has written Development and Future Prosperity: Innovation is the Essence of Israel's Growth, in Israeli Ingenuity: The Development of an Economic and Scientific Powerhouse, *From Modest Beginnings to a Vibrant State, ISRAEL AT 60.*

Figure 4. Foreign direct investment (FDI), net inflows (% of GDP)



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Brazil	5	4	3	2	3	2	2	3	3	2	2	3	3
China	3	3	3	3	3	5	5	5	4	3	5	4	3
India	1	1	1	1	1	1	2	2	4	3	2	2	1
Israel	6	1	1	3	2	3	10	5	5	2	2	4	3
Russian Federation	1	1	1	2	3	2	4	4	5	3	3	3	3
SA	1	6	1	0	0	3	0	2	3	3	1	1	1

Source: Based on the World Bank (2015) World Development Indicators data

2.12.2 Israel`s emphasis on Life Sciences

The OCS has always paid special attention to Israel's biotech sector, an industry where the risks are much higher and there is a much longer time until investors see returns, making it harder for projects to raise funds. Israeli researchers have developed highly successful medications, usually sold under license to overseas pharmaceutical companies.[66] The potential profits for such initiatives can be seen from Teva Pharmaceuticals' Copaxone treatment for multiple sclerosis, the first ethical drug marketed by an Israeli firm, which generates annual global sales of USD1.8 billion. Of course, biotech is about more than just profit, and the groundbreaking research in Israel has led to cures and therapies for diseases from cancer and heart problems to Parkinson's, diabetes and more. Although a relatively small industry in Israel, Life Sciences receive 27% of the grants from the R&D Fund and comprise 55% of the projects in the incubators[67]. In 2005, the OCS set up its first incubator dedicated to biotechnology in Jerusalem with far larger grants of up to USD1.8 million available per project over three years.

2.12.3 Israel`s new economic horizons

Israel's unique human capital is the most significant and important resource at its disposal. Translation of this into a global competitive advantage requires the implementation of R&D programs not only in the high-technology sector, but within traditional industries, as well. The important role of these particular industries in the Israeli economy is well-recognized. Furthermore, as they supply an essential platform for the smooth functioning of the entire industry, they also need significant leveraging of resources, partly done through developing internal R&D programs, which will enable them to successfully operate in Israel, as well as in increasingly competitive foreign markets. The OCS is certain that from the point of view of both the investor and technology developer, prominent and yielding niches, technologies and products may be found in this sector. A major new area of endeavor under OCS is clean-tech, in particular the development of water technologies.[68] This has stemmed from the need to provide for over seven million people in an arid region. Through more efficient management and irrigation, innovative desalination, the reclamation of wastewater and purification, the OCS has been able to make a little water go a long way.[69] IDE Technologies, with support from the OCS, has developed desalination plants using reverse osmosis and mechanical vapor compression to reduce energy costs for desalination.

[66] Ibid.
[67] Research & Development Funds in Israel - Israel Science and Technology Home Page: www.science.co.il/Research-Funds.asp.
[68] Dr Eli Opper
[69] Ibid.

3. Conclusion

The prosperity generated by Israeli advanced technology has indeed been a wonder to behold. But more importantly, those technologies have brought added value in health, nutrition, quality of life and the environment not only for Israel but for the entire world.

Israel has become prosperous because of its ability to add value through innovation. Because there are thousands of start-up companies, people have tried to crack the code of Israel. Every country has its own specialization and own advantages. However, according to Prime Minister Netanyahu (2014), the concentration of exceptionally gifted hi-tech start-up companies in Israel, is a function of five things which many countries can learn from especially developing countries. First, a curse that has been turned into a blessing: the defense needs. Israel has had to have a very robust defense, so it takes the best and the brightest young people into the military through various operations for three years. This has been a perpetual machine that produces knowledge workers and knowledge entrepreneurs who are gifted.

The second is research; Israel has excellent research institutions and universities. For example, the Technion, the Weizmann Institute and other exceptional universities. These have produced an inordinate share of Nobel Prize winners for Israel. Israel also spends 5% of GDP on R&D. Third, is a special culture. The Jewish people have always treasured education and knowledge. In ancient times they were effectively the only literate people known, because every father teach his son, not his daughter but his son how to read the Bible. And that brought them through the Middle Ages and into modern time with literary capacity. That was unusual (Netanyahu, 2014). When the walls of the ghetto broke down with the French Revolution, that discipline burst out into many areas: into physics and mathematics, into chemistry and so on. There was a culture there. So, from the Talmud to Einstein, the Jewish people were always asking questions, truth was never finite. It never ended. There was an iterative process from Jewish communities around the world trying to find out what is the right thing, what is the true thing? And that questioning mind, to Netanyahu (2014), is something that is in the Jewish culture.

Fourth, is size: Israel is a very small nation, the size of New Jersey or Wales and so everything is close by and everyone is close to everyone. Everybody competes with each other and collaborates with each other. There is an ongoing vibrant cross fertilization. So technology that is used for missiles can be put in a camera in a pill that goes into a digestive system to find out how healthy you are and where you are not healthy. The technology that is used to track data flow is used to track water flows and so on. And the fifth reason is because Israel has no choice and to survive, it had to innovate. Israel did not have abundant natural resources, was outnumbered and was facing constant threats. Israel`s was imposed with economic boycott by its neighbors and some world powers imposed weapons boycott. The only option was to innovate in order to survive.

The birth of modern Israel was an innovation. The rebirth of the Hebrew language was an innovation. The rebirth of agriculture which it had not done for 2,000 years was an innovation. Innovation changed Israel`s capacities in a very short space of time to become a key player in the world community. According to Netanyahu (2014), these five factors that converged together have created a unique situation, where through innovation the country has managed to produce more conceptual products per-capita than any other country on Earth.

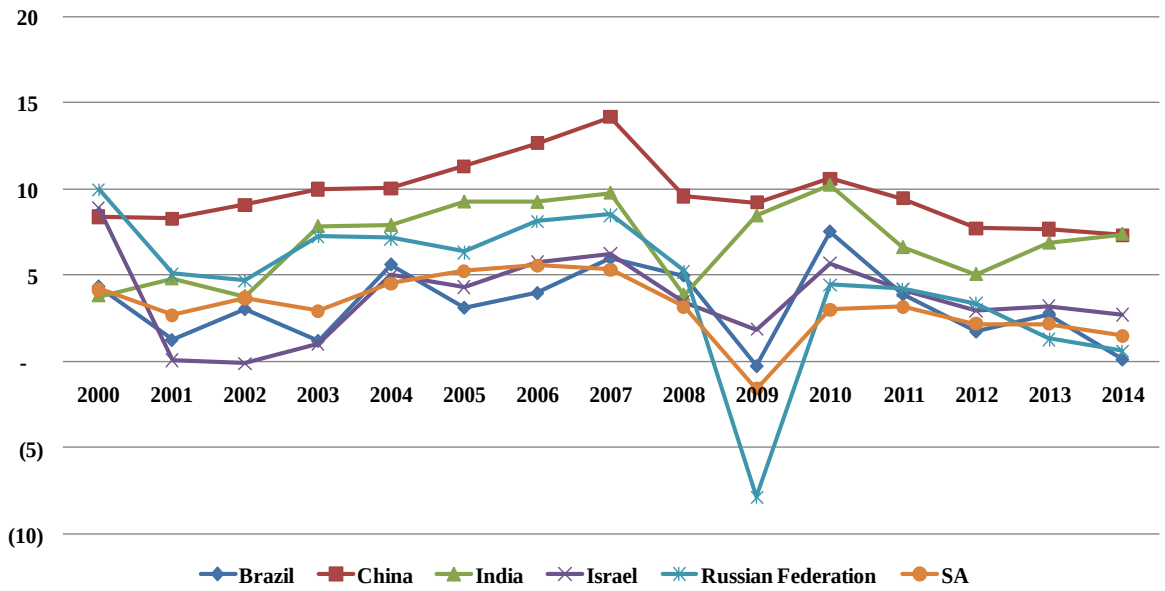
References

1. Berry, O. and Grayeff, Y. (2009). "Emerging markets: Israel`s Technology Industry as an economic growth engine," *Communications for the Association for Computing Machinery*, Vol. 52, No. 12. DOI:10.1145/1610252.1610264.
2. Brackman, L. and Jaffe, S. (2008). *Jewish wisdom for business success: Lessons from the Torah and other ancient texts*, AMACOM, Broadway, N.Y.
3. Deger, S., and Sen, S. (1995). "Military Expenditure and Developing Countries," in Handbook of Defense Economics, Vol. 1, Hartley and Sandler, Eds., Elsevier Science.
4. Dvir, D. and Tishler, A. (1999). "The Changing Role of the Defense Industry in Israel's Industrial and Technological Development," Working Paper 1/99, *Israel Institute of Business Research*, Tel Aviv University, Israel.
5. IMF (2014). "Israel: IMF country report no. 14/47, Staff report for the 2013 Article IV Consultation," *IMF Publication service*, Washington, D.C.
6. Lifshitz, Y. (2000). Defence Economics, The General Theory and the Israeli Case, The Jerusalem Institute for Israel Studies, and the Ministry of defence – Publishing House.
7. Maune, A. (2015). "Hillel the Elder: A Talmudic perspective of his leadership intelligence," *Risk Governance & Control: Financial Markets & Institutions*, Vol. 5, No.2, pp. 7-14.
8. Nasdaq (2015). "NASDAQ International Companies," http://www.nasdaq.com/asp/NonUSOutput.asp.
9. Nathanson, R. (2011). "Growth, economic policies and employment linkages: Israel," Employment sector, Employment working paper No. 83, *ILO Publications*, Geneva, Switzerland.
10. Netanyahu, B. (2014). World Economic Forum (WEF) address at Davos on 23 January, Retrieved from: http://mfa.gov.il/MFA/PressRoom/2014/Pages/PM-Netanyahu-addresses-World-Economic-Forum-at-Davos-23-Jan-2014.aspx.
11. Oz, Amos. Speech at the Israeli Presidential Conference, Jerusalem, May 14, 2008.
12. Peled, D. (2001). "Defense R&D and Economic Growth in Israel: A Research Agenda," A paper prepared for the "Science, Technology and the Economy," (STE), Program at the Samuel Neaman Institute for Advanced Research in Science and Technology, at the Technion-Israel Institute of Technology, Technion city, Haifa, Israel.

13. Senor, D. and Singer, S. (2009). *Start-up nation: The story of Israel`s economic miracle*, Twelve, Hachette Book Group, Inc., N.Y.
14. Teller, J. (1966). *The Jews: Biography of a people*, Bantam books, N.Y.
15. The World Bank. (2015). "World Development indicators." Washington, D.C., *The World Bank* (producer and distributor). Retrieved from http://data.worldbank.org/data-catalog/world-development-indicators.
16. Unterman, I. (1971). *The Talmud: An analytical guide to its history and teachings.* N.Y.: Bloch.
17. World Economic Forum (2014). The global competitiveness index report. (Online) Available from: http://reports.weforum.org/the-global-competitiveness-report.

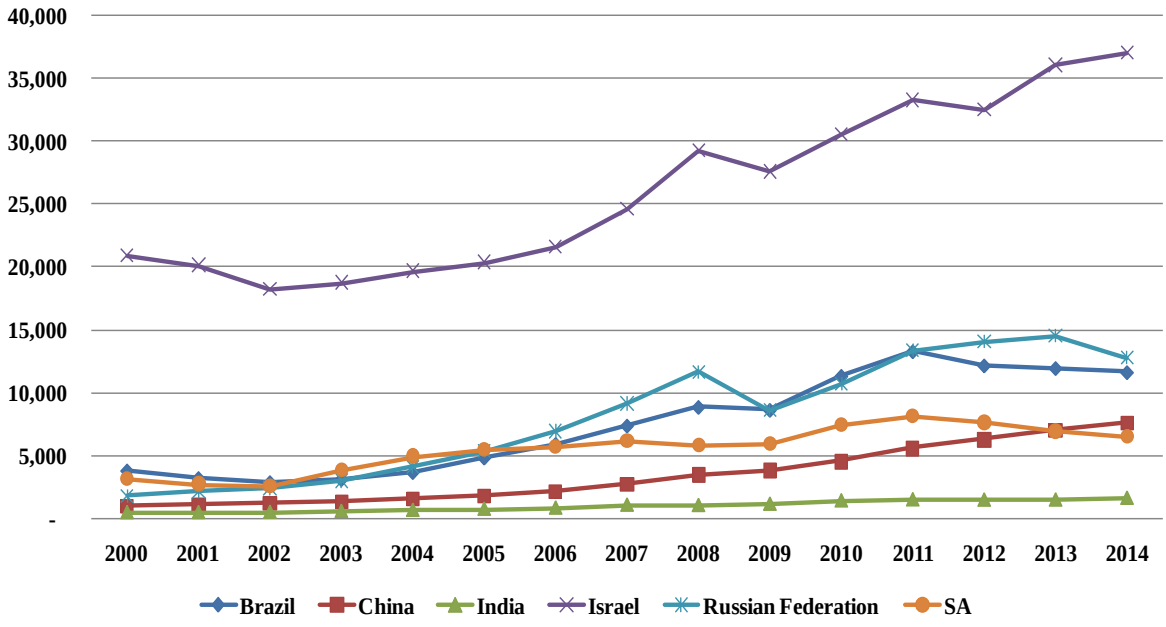
Appendix

A1. GDP growth (annual %)



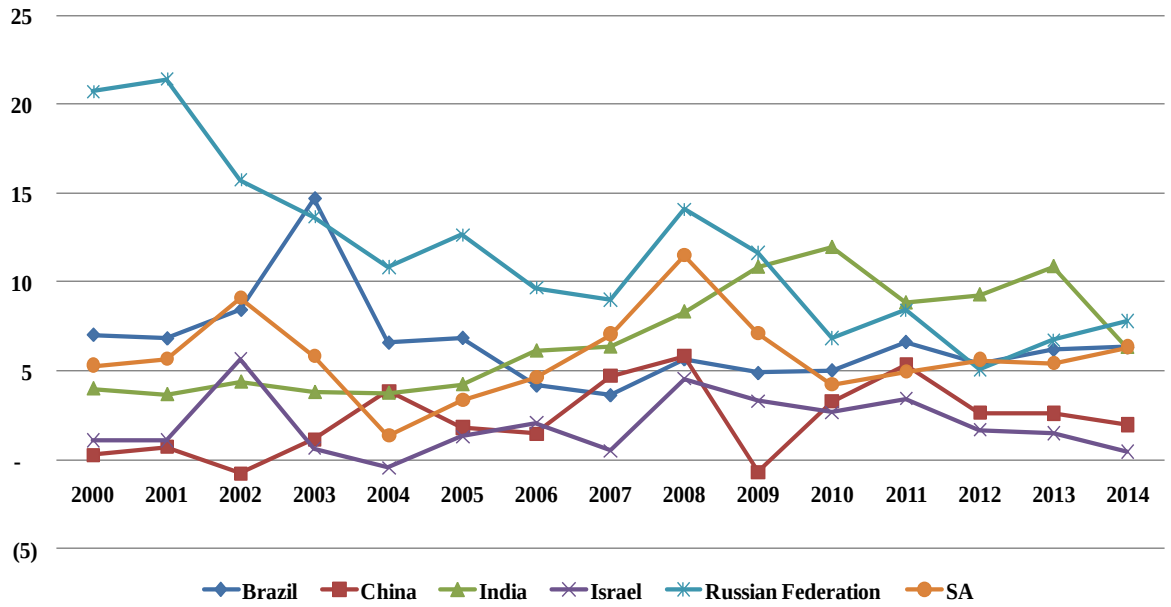
Source: Based on the World Bank (2015) World Development Indicators data

A2 . GDP per capita (current USD)



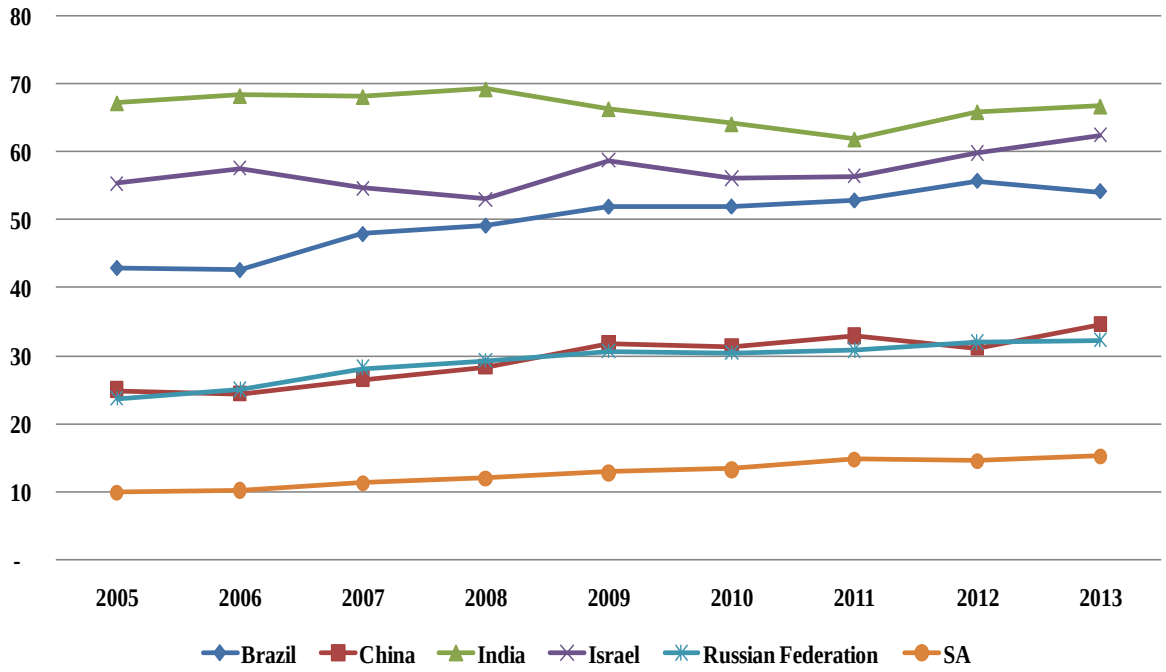
Source: Based on the World Bank (2015) World Development Indicators data

A3. Inflation, consumer prices (annual %)



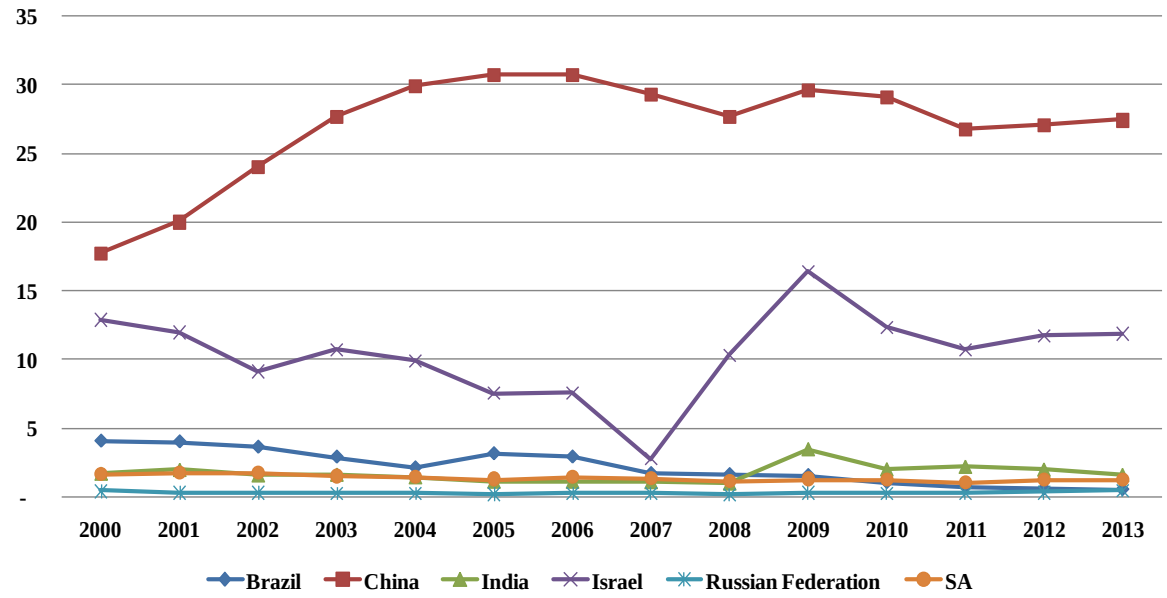
Source: Based on the World Bank (2015) World Development Indicators data

A4. ICT service exports (% of service exports, BoP)



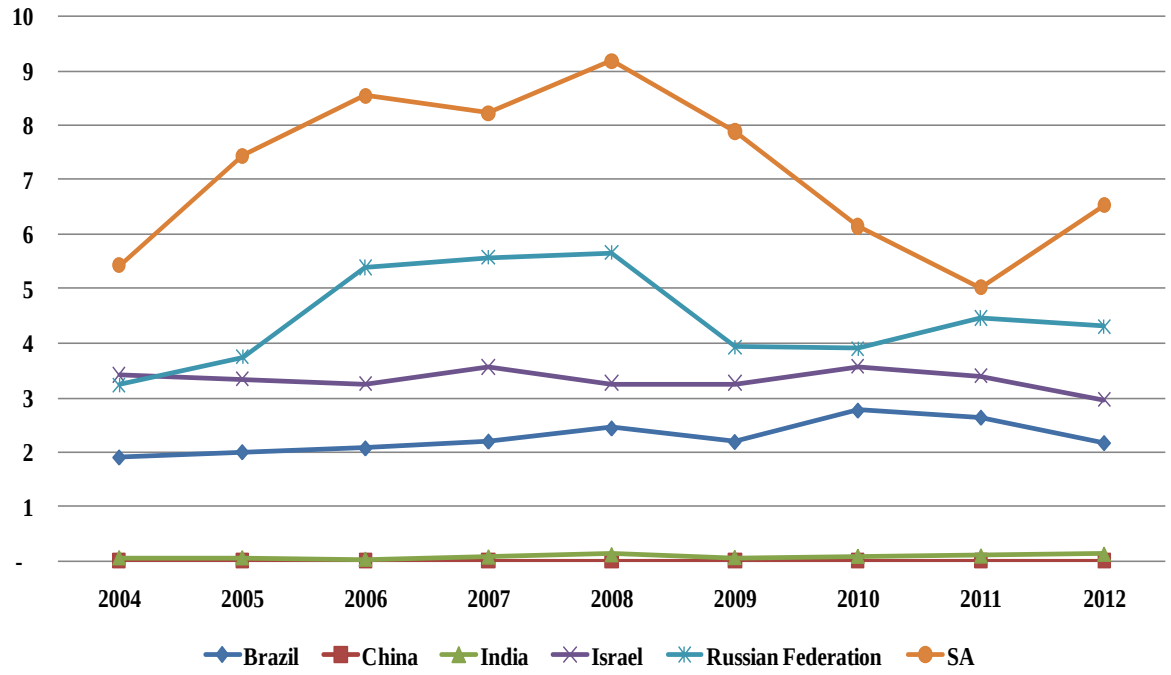
Source: Based on the World Bank (2015) World Development Indicators data

A5. ICT goods exports (% of total goods exports)



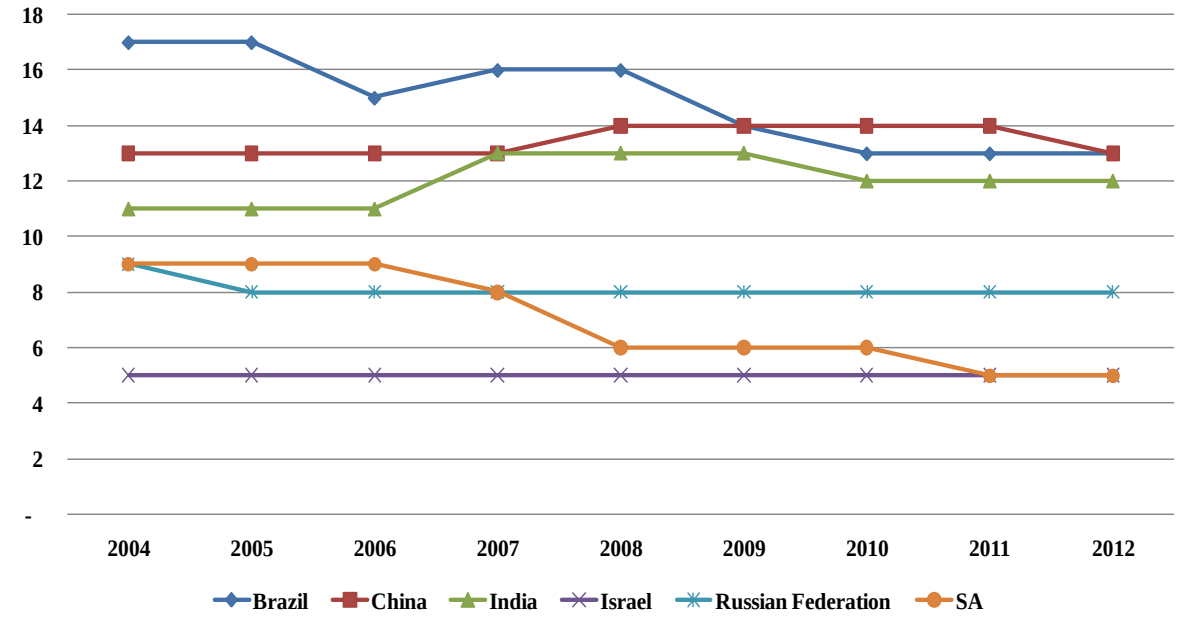
Source: Based on the World Bank (2015) World Development Indicators data

A6. New business density (new registrations per 1,000 people ages 15-64)



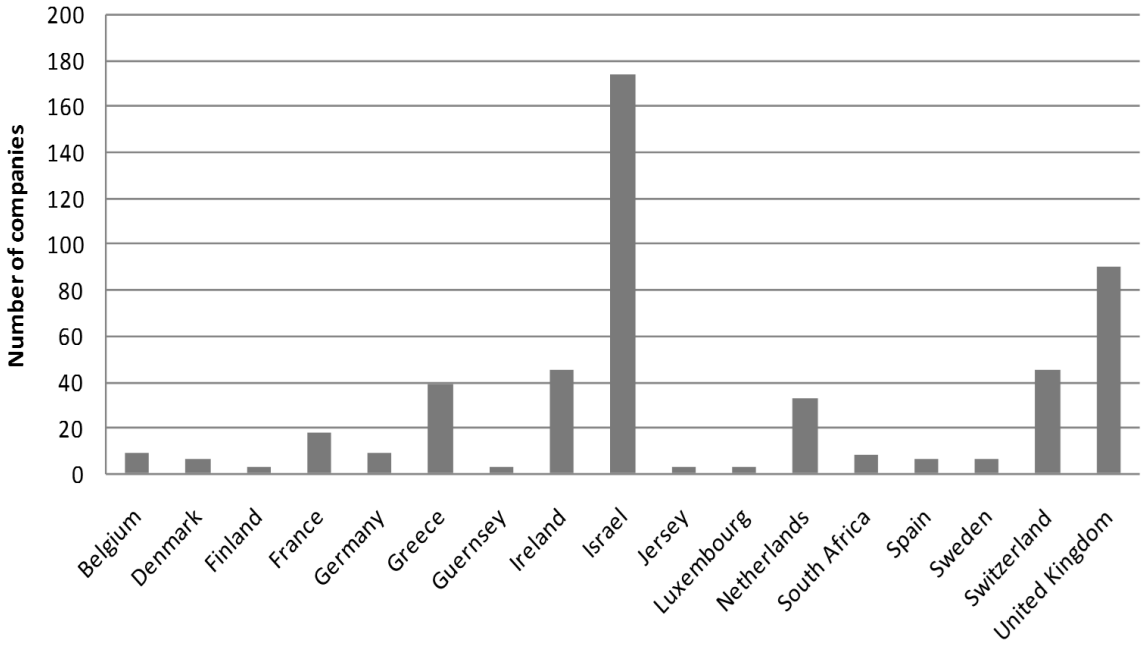
Source: Based on the World Bank (2015) World Development Indicators data

A7. Start-up procedures to register a business (number)



Source: Based on the World Bank (2015) World Development Indicators data

A8. Non-U.S. Companies on NASDAQ (2015)



Source: NASDAQ data, http://www.nasdaq.com/asp/ NonUsOutput.asp, July 2015

Table 1. Israel: Main Economic Indicators 2000-2014

Israel Year	FDI	Inflation	R&D	Military	GDP Growth	GDP per Capita	Physicians	Popn millions	Hi-Tech	Hi-Tech million USD	ICT Goods exports	New Business Registered	New Business Density	ICT service exports	Start-ups
2000	6.12	1.12	4.17	7.56	8.92	20,901.77	3.77	6.29	19.35	4,978.62	12.88	-	-	-	-
2001	1.37	1.12	4.45	7.96	0.11	20,126.84	3.91	6.44	18.64	4,438.38	11.95	-	-	-	-
2002	1.32	5.69	4.43	9.08	(0.06)	18,246.01	-	6.57	15.50	3,762.00	9.08	-	-	-	-
2003	2.65	0.67	4.17	9.10	1.08	18,755.27	3.82	6.69	16.85	4,526.72	10.67	-	-	-	5.00
2004	2.20	(0.41)	4.15	8.24	5.05	19,682.92	-	6.81	16.85	5,440.70	9.88	13,930.00	3.40	-	5.00
2005	3.41	1.33	4.31	7.62	4.34	20,376.70	-	6.93	14.03	4,969.66	7.51	14,364.00	3.34	55.37	5.00
2006	10.05	2.11	4.22	7.74	5.78	21,581.76	3.67	7.05	14.51	5,594.06	7.54	14,217.00	3.24	57.59	5.00
2007	4.98	0.51	4.52	7.17	6.27	24,606.12	3.63	7.18	7.48	3,065.42	2.72	15,871.00	3.55	54.67	5.00
2008	5.08	4.60	4.40	6.85	3.50	29,268.90	-	7.31	11.10	6,273.38	10.27	14,836.00	3.25	53.02	5.00
2009	2.15	3.32	4.17	6.87	1.90	27,583.45	-	7.49	17.62	7,889.76	16.38	15,211.00	3.26	58.80	5.00
2010	2.37	2.69	3.97	6.34	5.75	30,550.92	3.65	7.62	14.66	7,978.96	12.29	16,898.00	3.56	56.09	5.00
2011	3.52	3.46	3.97	6.00	4.19	33,276.36	3.35	7.77	13.98	8,825.59	10.69	16,383.00	3.39	56.43	5.00
2012	3.13	1.71	3.93	5.86	3.00	32,514.55	3.34	7.91	15.85	9,212.05	11.70	14,504.00	2.96	59.86	5.00
2013	4.06	1.53	-	5.65	3.25	36,050.70	-	8.06	15.61	9,634.61	11.84	-	-	62.47	5.00
2014	-	0.48	-	5.23	2.77	37,031.68	-	8.22	-	-	-	-	-	-	5.00

ICT service exports	ICT service exports (% of service exports, BoP)
FDI	Foreign direct investment, net inflows (% of GDP)
Inflation	Inflation, consumer prices (annual %)
R&D Exp	Research and development expenditure (% of GDP)
New business density	New business density (new registrations per 1,000 people ages 15-64)
New business registered	New businesses registered (number)
Start-ups	Start-up procedures to register a business (number)
Military	Military expenditure (% of GDP)
GDP	GDP growth (annual %)
GDP per Capita	GDP per capita (current US$)
Physicians	Physicians (per 1,000 people)
ICT service exports	ICT goods exports (% of total goods exports)
Hi-Tech million USD	High-technology exports (current US$)
Hi-Tech	High-technology exports (% of manufactured exports)

Source: *Based on the World Development Indicators data*

Table 2. Non-U.S. Companies and Market Capitalization on NASDAQ (2015)

Country	Count of IPOyear as of July 2015	Market Capitalization as of July 2015
Belgium	9	9,289,726,855.80
Denmark	6	6,922,225,549.20
Finland	3	732,696,384.30
France	18	19,485,088,740.60
Germany	9	3,721,751,452.74
Greece	39	7,435,689,633.90
Guernsey	3	26,114,980,200.00
Ireland	45	498,553,315,244.70
Israel	174	252,614,929,074.64
Jersey	3	18,128,851,470.00
Luxembourg	3	1,799,829,944.40
Netherlands	33	289,462,153,582.20
Spain	6	40,932,089,373.00
Sweden	6	104,677,180,131.30
Switzerkand	45	30,380,916,651.33
United Kingdom	90	1,049,641,953,703.33
Grand Total	492	2,359,353,377,991.44

Source: NASDAQ data, http://www.nasdaq.com/asp/ NonUsOutput.asp, July 2015