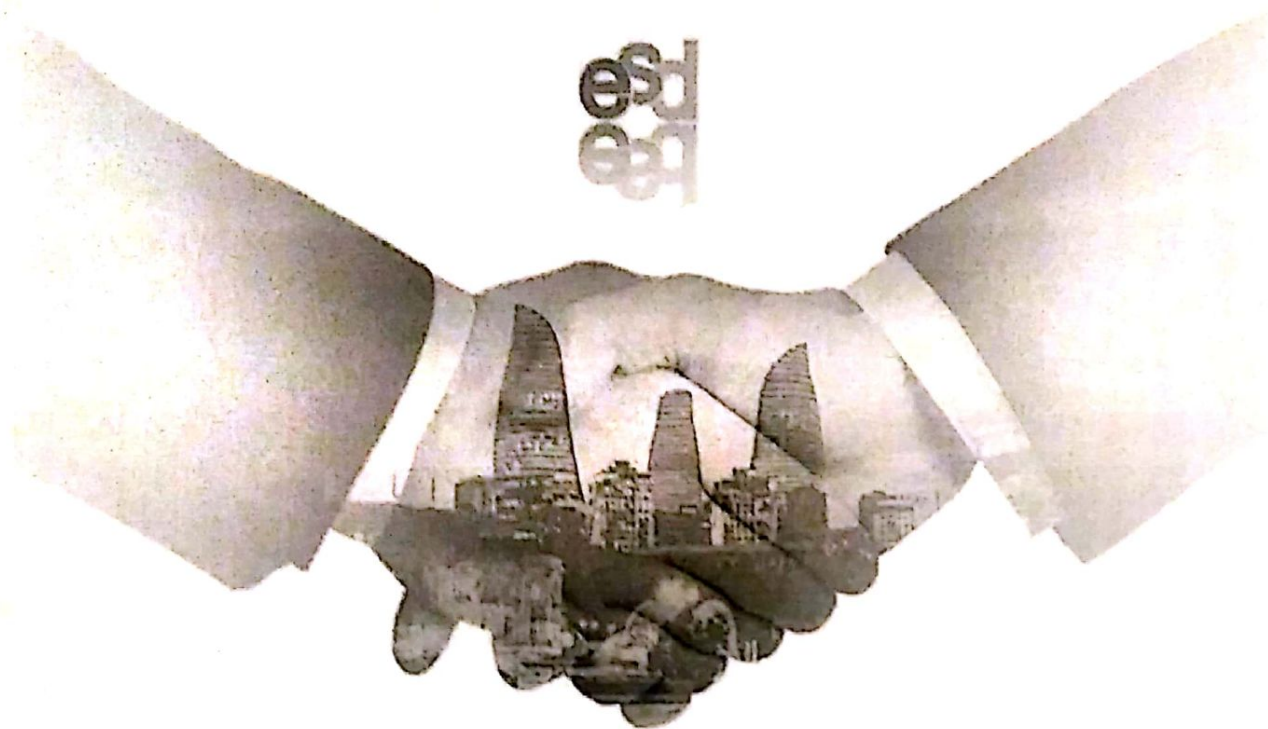


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BUILDING AN INNOVATION ECOSYSTEM IN AZERBAIJAN - ON THE BASIS OF THE STUDY OF ISRAELI PRACTICE

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ABSTRACT

Building a successful innovation ecosystem is a key factor in innovation, growth, and development. Formation of a favorable innovation ecosystem remains an essential policy priority for the government of Azerbaijan too. President of the Republic of Azerbaijan signed a decree on the establishment of the Innovation Agency under the Ministry of Transport, Communications and High Technologies of the Republic of Azerbaijan on November 6th, 2018. The Innovation Agency to be established in 2019 will be a coordinating body to draft and implement an innovation roadmap of an Azerbaijani ecosystem. This paper reviews world practice, including an Israeli practice of success to deduct results and models to build an ecosystem in Azerbaijan. The aim is to determine factors that made the Israeli ecosystem successful and study if these factors can be applied to the development and implementation of similar benchmarks in Azerbaijan. The methodology that is used for this research is the case study from Israel. Through systematic analysis and logical generalization, the paper analytically discusses and deducts conclusions from Israel's experience to spell out some key public policy lessons. While the paper finds out that the R&D grants, venture capital policies, developing skilled human capital and public-private partnerships were the reasons of the success of Israel, this paper also determines that government played a key role in stimulating these policies with successful outcomes in successful practice. The limitation of the research with the case is the generalizability of the case study. The practice of Israel does not mean that innovation will be successful in Azerbaijan.

Considering the above-mentioned issues, studying the world practice in the case of Israel is imperative from an academic point of view to define policy lessons for thriving innovation policy and investigate the possibility of implementation of related benchmarks in Azerbaijan.

After the establishment of the State of Israel in 1948, it was remaining an underdeveloped and rural country negatively affected by the war. However, Israel could successfully make a huge transformation into a global innovation powerhouse with multibillion innovation companies (David, 2016, p. 26). Haan and Golany (2011, p.130) determine Israel as a nation of innovation and entrepreneurship. In spite of its remote location, today Israel is a leader of medical, automotive technology and FinTech (World Finance, 2018). Encouraged by Intel's entrance into the Israeli market in 1974, hundreds of multinational corporations started investing in the high-tech sector in Israel (World Finance, 2018). Israel's innovation ecosystem can be mentioned as a good sample of success. As of September, 2nd 2018, multinational companies run 344 R&D centres in Israel (Haaretz, 2018). The companies that opened R&D centres in Israel include Facebook, General Electric (GE), Barclays, Google, IBM, PayPal, Dropbox, Huawei (Nocamels, 2018). Based on an available data, more than 20 billion dollars were spent for acquiring Israeli companies by multinational giants such as Facebook, Grubhub and Salesforce in 2018, while accurate numbers must be larger (Feller, 2018). Venture funds such as Sequoia Capital, Greylock, and Nokia Ventures have a strong presence in Israel (Kalish & Avni, 2016). The above-mentioned accomplishments, as well as the inflow of international venture firms into Israel, have been possible due to the uniqueness of innovation ecosystem in Israel. Lacked an abundance of natural resources, the priority of Israeli government was to innovate an economy since its early days. This paper will show that the government of Israel did not only pursue an active policy in terms of distributing R&D grants and funding for venture firms, but also stimulated the emergence of start-ups, public-private partnerships, and provided skilled human capital with right resources in order to create a strong innovation ecosystem.

2. THE CONCEPT OF INNOVATION ECOSYSTEM

Before we started to find out policy lessons for building an innovation ecosystem in Azerbaijan on the basis of the study of Israeli practice, this concept must be clarified.

2.1. What is Innovation?

Avidor writes that 'innovation is the conception, design, and implementation of new products and processes or changes to existing products and processes that create value for society' (Getz and Segal, 2008; referenced by Avidor, 2011, p. 4). Avidor mentions two forms of innovation. The first type of innovation which he calls 'high-order innovations' include the creation of new and disruptive technologies/solutions. The second type of innovation which he describes as 'low-order innovations' include small applications to enhance the efficiency of the existed technologies/processes (2011, p.4). Historically speaking, regardless of their low and high order, innovations have always served to the consolidation of economic efficiency and bolstered economic & societal development. Today's the most fortunate companies including Apple, Google, Alibaba, Microsoft, Facebook, IBM, Samsung, Toyota, SpaceX, and Amazon have reached a pinnacle of success thanks to their innovative products. Wealth creation has always been related to innovation (Jackson, 2015, p.1).

2.2. What is an Innovation Ecosystem?

'The term innovation ecosystem refers to a dynamic, interactive network that breeds innovation' (Oksanen, Hautamäki, 2014, p. 4). A widely believed agreement is that the main parties of innovation ecosystem include academic institutions, government agencies, policy-makers, research centers, venture funds, large companies and start-ups (Oksanen, Hautamäki, 2014, p. 4-5).

Briefly speaking, the development of an innovation ecosystem depends on the availability of skilled labor, research institutions, funding as well as the availability of private or government-sponsored infrastructure. Silicon Valley is a well-known example of an innovation ecosystem. India and Israel can also be mentioned as good examples of innovation ecosystems too. 'An innovation ecosystem is said to be thriving and healthy when the resources invested in the research economy (either through private, government or direct business investment) are subsequently replenished by innovation induced profit increases in the commercial economy' (Jackson, 2015, p.4). A strong ecosystem requires cooperation among individual investors, government agencies, and research centers (Wessner, 2004, p.1).

2.3. What are criteria of a sound Innovation Ecosystem?

Avidor elaborated its four-factor framework which highlights the importance of four criteria for a sound ecosystem which includes the availability of financial capital and skilled human resources, economic incentives, access to information (2011, p. 4). Despite the fact that the importance of these factors must be recognized, the role of government is unavoidable for consolidating an innovation ecosystem. Meanwhile, the government can not only play a crucial role in facilitating collaboration but also can support programs to create incentives for private investors to invest in innovative products/solutions. Investing in innovative products is deemed to be risky for private investors, as there is not an uncertain probability of success.

3. THE CASE OF ISRAEL: POLICY LESSONS FOR AZERBAIJAN

As mentioned earlier, Israel is one of the most developed countries which possess a well-functioning innovation economy. Multinational companies and international venture funds have actively participated in investing in Israeli technology companies and start-ups. It was Israeli governments' programs that made an effective innovation ecosystem. Therefore, it is a good case for an empiric study to understand the role of government in innovation policy. In 1948, when the State of Israel was established, it was a poor and agricultural country. Its economy was weakened by the war, and it had a little prospect of development. The country had scarce natural resources. Therefore, the government of Israel aspired to establish a robust innovation economy from the first days of its foundation (Claros, Mia, 2006, p.89). Claros and Mia (2006, p.89) write that 'recent Israeli economic history is an excellent showcase of the key contribution efficient government intervention can make to the overall innovation potential and ICT readiness of a nation'. As illustrated in the four-factor framework of Avidor and in the earlier theoretical studies, a number of primary factors are prerequisites to building a sustainable innovation ecosystem (2011, p. 4). These elements include the availability of financial capital, human resources, economic incentives, information access, as well as the collaboration and interaction between government, the private sector, educational & research centers and individual entrepreneurs who are aspired to produce innovative products/ solutions (Avidor, 2011, p.4).

3.1. Venture capital, public-private partnership & infrastructure, and human capital support policies in Israel

Avidor (21, p.21) mentions that 'Israel's policy planning, responses to market developments, and luck led to the creation of proper economic incentives, fluid access to financial capital, skilled human capital and robust connections to global information networks for the emergence of an innovation economy'. The most important factor for an innovation ecosystem is the availability of adequate financial capital. 'Innovation typically requires investment capital to pay for labor, office/lab space and/or materials. High-order R&D investments tend to require large up-front, uncollateralized cash and only offer varying probabilities of success' (Avidor, 2011, p. 6).

The requirement of uncollateralized cash and uncertain probabilities of success makes innovation project riskier for individual investors. Thus, a developed venture fund industry is crucial to financing inventions and technological creativity (Claros, Mia, 2006, p.99). 'Venture capital (VC) firms are specialized financial intermediaries formed to invest in startup firms on behalf of a pool of investors' (Avidor, 2011, p.9). Especially, the involvement of international venture funds is useful in countries with limited financial capital. Israel has also lacked VC funds in the early 1990s since the country had 2 VC funds (Avnimelech, 2009, p.12). The creation of the VC fund industry was a crucial priority to provide funding for innovative programs. Therefore, the most successful program of the Israeli government for nurturing VC fund industry, involving international capital as well as providing cooperation between private and government sectors was 'Yozma'. The program was launched in 1992 with the goal of creating a competitive VC industry and involving international VC funds in Israel (Avnimelech, 2009, p.4). Eventually, a 100M\$ state-owned VC fund was founded with the first objective of investing in 10 private funds (80M\$) and with the second objective of making direct investments in high tech companies in Israel (Avnimelech, 2009, p.5). The main regulation to invest in VC funds was that Yozma fund would invest 40% in a newly established VC fund by stipulating that a fund has to be an independent Israeli fund, has to raise the rest of finance (60%) by establishing limited partnership with an international venture fund while most investment decisions have to be made by international investors (Baygan, 2003, p. 16). Eventually, the program 'Yozma' did not only become a cornerstone program in building VC industry in Israel but also it provided early-stage funding for Israel companies to develop their products (Yin, 2017). In the 1990s, the venture capital investments increased from \$58 million by \$3.3 billion thereby making Israel second in the private equity market after the US (Yin, 2017). Between 1990 and 2008, there was a dramatic increase in the number of active VC funds in Israel. The number of venture funds increased from 2 to 68. Furthermore, Yozma promoted the cooperation between professional American VC funds and local Israeli funds as well as private and government sector. As a result of the involvement of international funding in locally established VC funds, Yozma funds increased by 250 million US dollars (Baygan, 2003, p. 16). As the availability of financial capital was one of the key factors for a sound innovation ecosystem, the Israel government did not only play an important role for providing funding for Israeli startups but also stimulated the creation of VC funds industry and the entrance of international VC funds into Israeli market under the Yozma program. Yozma program is considered an important program in VC fund policy. 'Inbal' was another program of Israel government for involving international investment in the innovation industry. The program which started in 1991 offered 70% equity guarantee for international VC funds which want to invest in Israeli start-ups (Baygan, 2003, p. 16). Although Inbal is not considered as successful as Yozma, it is important to note that the program can be characterized by its uniqueness for both attracting international VC funds by minimizing their risks. The program can offer incentives for global VC funds to invest in Israel start-ups. The third promising initiative that was designed to fill the funding gap for early innovation projects was the Technological Incubators Program of the Israeli Innovation Authority which was established in 1991. The Technological Incubators Program established 24 incubation centers (Yin, 2017). The program offered \$500,000 to \$800,000 for funding and incubating early-stage ideas for the period of two years (Yin, 2017). Incubators are hubs with the appropriate human and material resources which carried 1300 projects between 1991 and 2008 while involving additional private investment up to 3 billion US dollars (Avidor, 2011, p. 28). By initiating the Technological Incubators Program, the Israeli Innovation Authority did not only offer to fund for early-stage ideas that can be found risky by private investors but also established an extensive network of technology hubs to generate viable projects. In addition to the above-mentioned programs, the government of Israel offers R&D grants, especially to those products and solutions that are related to

innovation. Thus, the Office of the Chief Scientist was established in 1969 to encourage research and development in industrial innovation, and it distributed R&D grants (with an annual budget of \$500 million) between 1988 and 2000 (Avidor, 2011, p. 25). Israeli government's programs including Yozma, Inbal and the Technological Incubators Programs provided seed funding and R&D grant for early-stage ideas. The availability of financial capital is an essential component of a sound innovation ecosystem, and the programs of Israel created the emergence of VC industry and grants for funding early-stage ideas. As mentioned earlier, interaction and cooperation between private sectors, government, and individual investors are another essential component of a sound innovation ecosystem. It is important to mention that Yozma, the Technological Incubators program and Inbal promoted the cooperation and interaction between the parties of innovation. Another interesting program of the Israeli government was Magnet which started in 1993. Under this program, multi-year R&D grants were offered for an academic institution to cooperate with an industrial firm to produce innovative technologies/solutions, while the program provided 66% of the total R&D budget (Claros, Mia, 2006, 98). The program played an important role in facilitating cooperation between the academic and industrial sector and initiated the establishment of 31 consortia by 2005 (Claros, Mia, 2006, 98). The program can also be unique to facilitate interaction, inter-linkages, and cooperation between industry and university sector, and it creates incentives for a business sector to cooperate with universities and research centers. Uniqueness and effectiveness of Israeli government's programs is that the government took the responsibility of risky funding for technological start-ups, creative ideas and venture funds, while it offered economic incentives and infrastructure support (R&D grants, venture capital funding, early-stage investment in start-ups) for various sectors (venture funds, educational institutions, international venture funds, start-ups) to cooperate and interact with each other. While analyzing all programs, almost all of them intended not only funding but also promoting strong cooperation. The availability of funding stimulated the emergence of new start-ups, while venture policies fostered the dramatic increase in the number of venture funds. Development of human resource is another criterion for an effective innovation economy. Since Israel lacks natural resources, the government's another priority was to develop human capital through building a quality education system. Skilled engineers, scientists, and inventors can contribute to research and innovative product development. When the state of Israel was founded in 1948, another priority of the government was to enhance the quality of education and academic excellence with the special focus on preparation and training of world-class engineers, scientists and industrial managers (Claros, Mia, 2006, p. 91). In the early 1970s, a number of universities in Israel were offering world-class research and education including Ben Gurion University in Beer Sheva, the Technion in Haifa, the Weizman Institute in Rehovot, Hebrew University in Jerusalem, and the Universities of Haifa and Tel Aviv (Claros, Mia, 2006, p. 91). In the early 2000s, the Israeli workforce was one of the most educated in the world having world-class specialists in agriculture, engineering and natural sciences (Avidor, 2011, p.43). Finally, the activity of Innovation Authority of Israel is interesting to study from the perspective of international cooperation. Along with distributing R&D grants, the authority conducts its operation in Europe, Americas, Africa, and Pacific to find global opportunities for Israeli companies and cooperate with multinational corporations for joint projects (Innovation Israel, 2018).

3.2. Policy Lessons for Azerbaijan

A number of policy lessons can be deduced from the case of Israel to build an innovation ecosystem in Azerbaijan. First of all, the role of government is inevitable in innovation management and funding. Second, the Israeli case shows that the development of the innovation economy requires a huge financial investment.

Since these kinds of investments are risky for private companies, the government is supposed to both provide incentives and sponsorship in the sector innovation. Programs Yozma and Inbal can be mentioned as successful examples.

3.3. Development of VC fund industry

As the Israeli case shows the availability of capital and development of the VC industry is a key area in the development of the innovation ecosystem. Under programs of Yozma and Inbal, the government of Israel did not only encourage the development of VC fund industry but also created incentives for foreign venture funds to enter Israel. This can be a good public policy lesson for Azerbaijan as the government of Azerbaijan should consider in both enacting laws on the management of VC industry as well as providing financial support for venture funds under its Innovation Agency. As Azerbaijan is a small country, it lacks financial capital. There is a need for contributions from international venture funds. The government venture fund can be established and should offer incentives for foreign venture funds. Involvement of foreign venture funds in Azerbaijani is also good practice from the perspective that the country lacks the professional expertise in terms of making investment decisions. Development of VC fund industry should be a priority in the innovation roadmap of Azerbaijan.

3.4. Provision of the collaboration between academia, industry, and government

The second policy lesson for Azerbaijan is that interaction and cooperation between the government and industrial sectors as well as education/research institutions are very important. There is not a culture of cooperation between the industrial sector and education/research institutions in Azerbaijan partially because it was a part of former the Soviet Union. As Israel's experience shows, the Magnet program incentivized the development of cooperation between industrial and academic sector by providing grants to develop innovative products. It is necessary to develop a similar grant scheme under the Innovation Agency in Azerbaijan to offer grants in reasonable amounts to facilitate the cooperation between industry and research. It will definitely increase interests of academic and industrial sectors to apply for grants. There are many academicians and researchers in Azerbaijan who have theoretical inventions, but they really need funding for development, testing, and commercialization. Cooperation with the industrial sector for commercial feasibility is a must. The design and implementation of similar grant schemes will definitely contribute to the development of interaction between various sectors and offer further incentives for the cooperation.

3.5. Funding support, infrastructure, and resource provision

Another lesson from Israel can be deducted from Technological Incubators Programs which supported the development and realization of proper funding, incubation and infrastructure support. Surely, development a favorable infrastructure and technological incubators with the right resources and available funding should be considered as a good benchmark for Azerbaijan too. Establishment of incubation centers, hubs and provide the incubation programs with the right resources and labs should also be considered for Azerbaijan. As Yozma experience shows that state-funding scheme should be created for start-up companies. Having a government funding scheme and resources will definitely stimulate the emergence and the growth of Azerbaijani start-ups. A good lesson is that the formation of proper innovation infrastructure and its maintenance should be a government task. Investment in start-ups can be riskier from cultural and business points of view. The government can establish a program to provide equity guarantees for private investors too.

3.6. Development of human capital

Israeli experience shows that the availability of human capital is also important for an innovation ecosystem. The government should cooperate with universities to build the capacity of departments that provide technical education programs while specialized training courses are for managers and engineers. Study tours, international training courses and increasing the capacity of key participants of the innovation ecosystem should be useful from this point of view. Meanwhile, funding schemes and R&D grants can be provided with Technological Incubators Program or under the program like Magnet which offers to fund but also stimulates a business sector and universities to cooperate on the development of certain innovation programs.

3.7. International collaborations

Final policy lesson for Azerbaijan is that international cooperation should be maintained as a priority. Economic, tax and other types of incentives should be created to involve R&D centers of foreign companies in Azerbaijan as well as provide the involvement of foreign venture funds. Israeli experience shows that the government played a key role in almost all levels of development of the innovation ecosystem in Israel. The role of government should also be organized in a way that it can find our global opportunities of cooperation for companies. At the same time, the government should provide the companies with resources to get access to international sources of finance and collaboration.

4. CONCLUSION

This paper reviewed and deducted policy lessons for Azerbaijan by analyzing and discussing the policies and programs in Israel for building innovation ecosystem. The main finding of this paper is that the government has a vital role in building the innovation ecosystem, as the Israeli case showed. The paper deducted that several factors and policies of Israeli government made it one of the best innovation ecosystems in the world, including VC fund policies, R&D grants, facilitating public-private partnership support as well as sponsorship support for start-ups. Based on Israel experience, the paper determined several key policy lessons for Azerbaijan which include the development of VC fund industry, provision of cooperation between academia, industry, and government, start-up funding, infrastructure support, human capital development and international cooperation. The paper also determined that a successful innovation economy depends on the formation of a successful innovation ecosystem. Innovation ecosystem is successful when there is cooperation between various sectors and developed VC fund industry. The successful government programs can support developed venture capital industry, facilitate the cooperation, develop infrastructure and create incentives for international cooperation. The main directions for Innovation Agencies were determined which include:

1. Active participation in the development of VC fund industry;
2. Provision of incentives for the cooperation between industrial sector and research institutions;
3. Fostering the commercial and R&D cooperation between start-ups, multinational companies, and government agencies;
4. Rendering investment grants to start-ups;
5. Development of innovation infrastructure, hubs and technological/business incubators;
6. Supporting and facilitating international cooperation and linkages.

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