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Innovation Policies and Government Instruments – An illustration of Israel's innovation system

By Deniz Gündoğdu, Nico Metzner, Giuliano Nucaro and Julia Seitz

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Abstract

The aim of this paper is to introduce innovation policy measures, government instruments and conceptual approaches to promote innovation growth. Since Israel is increasingly establishing itself as a pioneer for innovation, this paper mainly refers to their innovation policy. This paper will explain why Israel's innovation policy is successful and which actors play a particularly important role in it. Using semi-structured interviews, government experts like the Israel Innovation Authority as well as companies like Bosch were asked about Israel's national innovation system and its success which allowed diverse perspectives on the topic.

1. Introduction

Economic growth, prosperity, as well as international competitiveness are factors driven by globalization and are tightly connected to innovations. The globalization of the markets and increasing internationalization of the economy lead to highly competitive pressure which countries must face. This essay defines, based on a literature review innovation, innovation policy and the importance of these. It also describes why government-support for innovations is gaining in importance and which instruments for promoting innovation are available to the public sector. The success factors for an effective and future-oriented innovation system as well as its actors and innovation-promoting instruments are introduced and described using the example of Israel.

2. Definitions of terms - innovations and innovation policy

In general, innovations are novelties or significant improvements of a subject or of a way of acting, which can lead to a change in and for enterprises. (Möhrle, 2018) Through more advanced solutions and technologies, innovations can be used to solve problems. (Welsch , 2005, p. 32) Innovations are discovered, invented, introduced, used, applied, and ultimately institutionalized. (Möhrle, 2018) By driving innovations, new organizational forms, products, new process engineering and technologies are created. This helps both nationally and internationally to gain a competitive edge and a temporary monopoly position in the market. In macroeconomic terms innovations are an important growth driver for nations and companies. (Hotz-Hart & Rohner, 2014, p. 1; Welsch , 2005, p. 32)

It is important to promote and advance innovations, in which the state and its respective innovation policy is assigned a central role. Through innovation policy, public authorities attempt to drive forward technological change and influence it in a certain way by means of various measures. In this context, innovation policy encompasses not only technology policy but also elements from other policy fields such as infrastructure policy, research and development

(R&D) policy, and industrial policy. (Bauer, et al., 2012, p. 13 f.) Innovation policy forms the interface between a nation's research and technological development policy and its industrial policy. (European Parliament, 2021) In this context, innovation policy not only promotes R&D activities, but also investments in human capital as well as in education and training policy. (Welsch , 2005, p. 40 f.) In summary, government innovation policy encompasses all measures, strategies and controls undertaken by the government to steer the scope, nature, and direction of innovation processes in the economy and society. (Welsch , 2005, p. 195)

In this context, innovation policy control functions can refer to the control of intermediary institutions in the research system and economy also called technology transfer institutions. Furthermore, they influence the design of developments in the education and research system. Another political control function is infrastructure required for innovations. Possible areas of influence are the provision of venture capital, the structuring of property rights, as well as the definition of suitable standards and norms. In addition, frameworks for the innovation process could be defined which relate to the design of the general control system, the promotion of a good climate for innovative companies, and the creation of good financing conditions. (Welsch , 2005, p. 77 ff.)

In addition to the above-mentioned fields of action on the political side, the interaction between players involved in technology developments take an important role too. This is referred to as national innovation systems (NIS). (OECD, 1997, p. 7 f.) Through these NIS, which include the R&D departments of companies, universities, research and technology institutions on the one hand, but also government institutions on the other hand, knowledge, expanded capabilities and more advanced technologies are discovered, imported, transformed, and distributed more quickly. (Welsch , 2005, p. 71 f. ; Hotz-Hart & Rohner, 2014, p. 147)

Appropriate instruments and measures undertaken by the state are needed to drive innovation policy goals. How individual nations and regions handle this, which measures they use to promote innovation and what structure their NIS has will be explained in the following chapter based on practical examples.

3. Government instruments

Innovation policies are aligned among others on supply and demand driven factors. (Welsch, 2005, p. 304) Supply driven innovation policy, also known as “science push approach”, endeavors an optimal control of technical progress through market forces. The science push approach is mainly used in consumer sectors in which it thrives for product improvements. The demand driven innovation policy focuses on developments with a potential in solving current or future economical, ecological, and social obstacles. Future application potentials can be found where regions face a scarcity of indispensable resources for further development or where regions develop new demand with increasing social importance. Demand driven innovation policy is used in countries where governments own a vast stake of the market’s demand. (Gerybadze, 2015) Studies show complementarity between procurement policy and research R&D funding policy. (Nolan & Warwick, 2014) An example can be found in the US procurement policy which works as a major driver for innovations. Government institutions like the Defense Advanced Research Project Agency (DARPA) and the National Aeronautics and Space Administration (NASA) contributed crucial technological advances. (Atkinson, 2020; Gerybadze, 2015)

Activities for driving innovation initiated by a government’s innovation policy can be classified as tough or soft activities which both result in influencing recipients such as companies and institutions. Tough activities, include e.g., laws, commandments or technical regulations but also appear often as monetary factors and have a direct impact in recipient’s behavior and actions. Tough activities are distinguished between direct funding such as financial grants like subventions and public orders or indirect funding, such as tax credits. While tough activities engage direct influence, soft activities result in controlling the recipient’s behavior by influencing their environment and circumstances. Main activities are moral suasion, information input, and exchange or consulting and coordination of the decision maker. One common tool is the establishment of forums for technological dialogue to create consensus. (Welsch, 2005, p. 229)

Companies might not venture to invest for R&D due to operational, commercial, and financial uncertainties like attracting enough customers and not achieving the expected revenue. (INI) To reduce these risk factors, governments have a wide range of tools at their disposal. Supporting R&D, which allows companies to compete internationally, can be reached by R&D tax credits and, allowances or direct R&D grants. While tax credits reduce the final tax liability, tax allowances reduce the taxable income. (OECD, 2002, p. 14) According to the OECD 32 out of 37 OECD member states offer R&D tax incentives. (OECD, 2020, p. 2) One risk of tax incentives is relabeling of further company expenditure as R&D costs which can be prevented with direct R&D grants. (Bloom, et al., 2019, p. 170) Direct R&D grants are financial support which often cover the personnel and equipment costs of specific projects. (GTAI) Several government programs offer grant funding to encourage innovation. The US government supports academic research through the US National Institute of Health with an annual budget of 42 billion USD. (Peterson, 2020) The Small Business Innovation Research program funds 150 private firms with an total annual budget of 3,4 billion USD. (Plimpton, 2018) The German federal Ministry for economic affairs and energy invests 3 % each year of the country’s gross domestic product (around 70 billion EUR) in high-tech industry’s R&D activities. (GTAI)

A country's innovation development depends primarily on its scientists. These workers either come from domestic universities and educational programs or are attracted from abroad. Regardless of how high the demand for research and innovation through tax incentives and direct grants is, this can only be achieved by having a sufficient number of scientists working on supplying these innovations. (Romer, 2001, p. 228 ff.) studies from Finland and Italy confirm a causal effect between growing up near technical institutions like universities and an increase of graduates in STEM (science, technology, engineering and mathematics) related studies which leads to a long-term increase in innovations. (Bianchi & Giorcelli, 2019, p. 29; Toivanen & Väänänen, 2016) Gaining more human capital is also achieved by an open immigration policy. A study on innovation and immigration shows a positive effect between these two factors with a surplus of 0,4 patents per 1000 inhabitants achieved by 12,000 immigrants, which increases the relative mean by 12 %. (Burchardi, et al., 2019, p. 16) An example is set by the USA where Immigrants make up 26 % of STEM workforce and 31 % of all PhDs. (Shambaugh, et al., 2017)

Free trade encourages innovation, especially in markets with a lower level of competition. Existing empirical evidence shows that promotion of free trade can boost new products and services. The replacement effect describes that monopolists enjoy benefits of high entry barriers which leads to a lower innovation level, while new entrants depend on innovations to establish themselves in markets. Allowing tough competition will induce companies and managers to innovate more. (Arrow, 1962, p. 609 ff)

The journal of Economic Perspectives researched and evaluated innovation policy tools. The paper investigated quality of evidence, conclusiveness of evidence, net benefit, time frame and effect on inequality. R&D tax credits, as well as skilled immigration, were classified as very effective especially in the short-run (three to four years) while direct R&D grants and incentives for universities show main benefit in the medium-run (five to nine years). Increasing supply of STEM human capital is the most effective in the long-run (10 years and longer). (Bloom, et al., 2019, p. 180)

| Policy | Quality of evidence | Conclusion of evidence | Net benefit (1-3) | Time frame | Effect on inequality |
|---------------------------|---------------------|------------------------|-------------------|---------------------|----------------------|
| Direct R&D grants | medium | medium | ** | medium run | ↑ |
| R&D tax credits | high | high | *** | short run | ↑ |
| Skilled immigration | high | high | *** | short to medium run | ↓ |
| Universities: incentives | medium | low | * | medium run | ↑ |
| Universities: STEM supply | medium | medium | ** | long run | ↓ |
| Trade and competition | high | medium | *** | medium run | ↑ |

(Bloom, et al., 2019, p. 180)

4. Innovation policies and government instruments in Israel

4.1 Success factors of Israel's innovation system

Today, Israel is one of the most innovative countries around the world and a pioneer in the field of cybersecurity. (Mátle, 2019) The following chapter will analyze how Israel achieved its level of innovation and what the factors of success are.

Shortly after the founding of the state in 1948, the neighboring Arab countries declared war on Israel. Due to the lack of support, which was repeated several times in the course of history, Israel decided not to rely anymore to the military support from other states. (Mátle, 2019) Based on this incident, Israel concluded to invest in R&D in the defense industry to reduce the dependence from foreign defense equipment. In addition to the military conflicts, the country faced huge economic difficulties too. Due to poor trade relations with bordering countries, a pronounced lack of fertile land, mineral resources, fossil fuels and an insufficient water supply the economy was faced with numerous challenges as well as it was isolated from the international politics. (Hofmann, 2008) The first immigrants came from different environments and geographies, spoke different languages, and formed the basis for the first phase of innovation in the field of agriculture and irrigation. (Abraham, 2021) The first wave of multinational companies establishing R&D centers in Israel began in the 1970s. Following the second influx of immigrants from the collapse of the former Soviet Union, the establishment of the first venture capitalists and the influx of qualified engineers from the defense industry, the ecosystem expanded and strongly increased. (Abraham, 2021) Through the "dot.com" period during the turn of the century the worldwide demand for information and communication technology skyrocketed, specifically in areas in which Israeli military technologies were very strong. (Abraham, 2021; Yaman Kouli, 2020) That led to a significant flow of investments and instigated a massive merger and acquisition by multinational and tech-savvy companies. Based on the mentioned facts, Israel's history already allows to deduce key factors for the successful innovation system. The hardship from a lack of military support led to early investments in R&D and several waves of immigration enabled Israeli companies to involve highly qualified employees. (Shalev, 2021)

The existing culture also represents an elementary driver for the working ecosystem in Israel. In general, the Israeli's are very informal. Hierarchies are not very important which invites people to express their opinions freely. (Shalev, 2021) A special part of Israeli personality is defined in the word "chutzpah". "Chutzpah" refers to being fearless in facing something new and illustrates an open attitude toward foreign situation or people. (König, 2019) Overall, the Israeli population lives a very technologically understanding and risk-taking culture. Failures resulting from a high risk-taking attitude are not punished and the mindset is holistically with a tremendous pro-innovation point of view. (Abraham, 2021)

The Military service as further factor of success represents a particular part of the ecosystem. For most people, the military service is mandatory in which already young Israelis develop responsibility, discipline, learn how to focus on achieving goals, develop knowledge about leadership and get in touch with cutting edge technologies. Furthermore, the collaboration is carried in working groups, so the education creates a very strong social network, which often turns into a professional network later. (Abraham, 2021) Together with several big research universities the military develops a lot of innovative technologies especially in the field of cybersecurity. The combination of a disciplined military education, competent and well-known

universities as well as a goal-oriented culture form the construct of the successful innovation system in Israel. (Shalev, 2021)

4.2 Israel's National Innovation System and its Actors

This paragraph introduces the main forces of the NIS in Israel. Generally, technical progress and innovation result from a complex network of relationships among players producing, distributing, and applying various kinds of knowledge. The innovation performance of a country is especially driven by the relation between these actors and how each one of them carries out in a collective system of knowledge creation and use. (OECD, 1997)

Throughout the past decades Israel established a NIS that contains all the ingredients of the innovation cycle. (Maris, 2021) "Its national Science and Innovation system is characterized by an R&D intensity above EU Average (overall R&D investment: US\$ 6,670 bn = 4,9% of GDP) and a highly developed Public and Private Sector research infrastructure". (European Commission, 2006) Since Israel is a small country which doesn't have any natural resources or much financial and human capital to build a giant industry, three main actors – firms, government and universities – can be identified to build the competitive advantage on knowledge. Next to them, due to their substantial part in Israel's NIS, further technology transfer organizations – technical incubators, venture capital institutions – can be integrated. (Abraham, 2021) Moreover, the group of firms represent four subgroups, these are local start-ups, other local firms, R&D centers of foreign companies, and foreign firms located outside the Israeli market. As stated before, the NIS is also influenced by several environmental factors, for instance military R&D, geopolitics, human capital, culture, and the R&D law. (Shalev, 2021) All in all, the different ingredients can be separated into drivers and enablers, however depending on the point of view most of them can be both. (Abraham, 2021)

Since Israel is based on knowledge-intensive sectors the most common knowledge transformation avenue runs from universities to firms throughout research result commercialization. (Rykower, 2021) Furthermore, due to military defense forces graduates and university graduates the knowledge flow is embodied in human capital transfer as well as in joint R&D cooperations of commercial enterprises and universities based on several government programs. (Nowak, 2011; Shalev, 2021; Abraham, 2021)

The following part outlines the main structural elements of Israel's NIS in more detail. The local innovation policies are mainly designed to form and ensure the functionality of the ecosystem within the framework of commercialized technologies. (Milana, 2020) The basis of the system is the Knesset's Science and Technology Committee (Parliament) which is responsible for Israel's general civilian research policies. For this purpose, it interacts with the National Council of R&D as well as the government's office of chief scientist. In addition to that, all government ministries employ chief scientists with respective offices. (European Commission, 2006) Since the institutions operating under the Law for Encouragement of Industrial Research and Development (R&D Law) they were able to build a stable and clear policy that aims to establish Israel as a world leader in innovation and entrepreneurship. (Shalev, 2021) In 2016 pursuant to a major amendment in R&D Law the government established the Israel Innovation Authority which is more independent in supporting and promoting innovation. (Abraham, 2021) On a macro-level that means providing a stable governmental support policy that is little affected by political changes. Furthermore, the implementation of environmental R&D policies to foster the

development of alternative areas, since there may not be market demand. (Shalev, 2021; Fischer, 2018) During the growth of the whole ecosystem the amount of influence of the Innovation Authority was getting smaller and today most of the popular investments are private ones. Nevertheless, the special feature in Israel's innovation ecosystem is that the Innovation Authority established a bottom-up approach policy. This means it deliberately refrains from over intervention and guidance and involves the private sector in designing ideas for research projects. From their point of view a government institution can never understand the market as well as startups and entrepreneurs do. (Abraham, 2021; Shalev, 2021)

4.3 Conceptual Approaches in Israel

Based on Israel's NIS approach the subsequent paragraph takes a closer look at different policies as well as promotion tools. Over the years the State of Israel supported the development of a thriving innovation ecosystem by providing various tools to support R&D. However, due to technological spillover and high level of risk, R&D is signified to a lower financial benefit to the investing institution than what the market views as an optimal level. Therefore, governmental policies and instruments are required to reduce the company's risk and compensate these market failures. (Israel Innovation Authority, 2021)

Generally, the overall facility includes various promotion tools, for instance tax incentives, free trade and human resource promotion, direct grants for R&D as well as guarantees and surety. In the early 90s the essential basis of the ecosystem occurred, as the government facilitated the creation of the Israeli VC industry, by attracting foreign capital and expertise. (Abraham, 2021) According to the chamber of commerce the reason for this was the dissolution of the Soviet Union with anti-Semitic side effects, which led to the result of many Jews emigrating to Israel. Since these people were unemployed but simultaneously highly skilled (e.g., doctors, engineers, and academics) the government invested more than 100 Mio. USD to create new jobs as well as an overall network. Over time these jobs developed into incubators which are one of the most effective instruments to support R&D. Nowadays, Israel offers a high number of incubators, each specializing in a different sector. More than 20 of them are financially promoted by the government (85% from the Innovation Authority and 15% from the incubator). Generally, these programs support entrepreneurs interested in founding a company and providing a lower risk, attractive investments, certainty, necessary infrastructure, experienced partners, and collaborations. (Rykower, 2021)

On the other hand, the Innovation Authority also provides direct grants to minimize the risk. Therefore, funds are provided to support the individual layers of the ecosystem. For instance, single entrepreneurs, startups, R&D institutions, funds for market research and analysis or money to set up incubator- and accelerator programs. (Abraham, 2021) The provided money is mainly used for businesses in areas in which the private market, due to longer development processes and in this context a later return on investment, does not invest, e.g., life science, nanotechnology, or sustainability. (Fischer, 2018; Shalev, 2021) Thereby, the authority is never providing the complete amount of the demanded funding, which in their opinion is a motivation for the founders and creates greater innovations since the businesses are still in need of private equity. The risk for businesses is minimize which means that the subsidized businesses are only obliged to repay the grants if the respective project leads to sales. In this case the repayment rate is usually 3 percent of the turnover until the grant amount is fully repaid. (Maris, 2021; Shalev, 2021) Therefore, three indicators are significant when the authority is looking

for subsidized businesses. First, how unique, new and disruptive the idea is. Second, the capability of the team to execute the program and third, the commercial potential. (Maris, 2021) The governments innovation policy also includes assistance in permits, licenses, and other overall administrative processes. (Tilz, 2021)

R&D employees in Israel's high-tech industry are one of the most important resources preserving the State of Israel's leading position and competitiveness, thereby contributing a lot to its economy. Nevertheless, through the high number of MNC's and the so-called brain drain Israel is facing a war of talents – the main barrier of organic growth. So, the high demand for human capital leads to extremely high wages which small startups, compared to MNC's, cannot afford. To solve this problem, the authority already launched the program "Human Capital for High-Tech funds" that aims at sustaining these capabilities and offering a solution. The program is operating in the recruitment, sorting, training, internship, and placement of new and existing employees. Since this is not enough, Israel needs more comprising policies to include inter alia sections of the population which are high-tech players to a less extent to close this gap. Potential participants are women, Arabs, and ultra-orthodox men. (Abraham, 2021; Shalev, 2021; Rykower, 2021)

Today, Israel is considered a leading innovation hub and generates extensive investments in the R&D sectors. The exceptional government innovation policy accomplished many achievements and the country gained large quantities of technological know-how. (Israel Innovation Authority, 2021) Particularly regarding the latter Israel is also facing a challenge. Many companies conduct R&D in Israel and then export the resulting value into a foreign country. Therefore, it is crucial that Israel keeps its edge and moves on in the value chain from a start-up into a scale-up nation. (Abraham, 2021) This means, founding start-ups and selling them to MNC's is insufficient. It is important to reduce early exits and increase in the value by building manufacturing and capabilities in the country. (Shalev, 2021) Therefore, the aim of the government is to create appropriate framework conditions to generate large scale effects and become a better place for businesses. (Maris, 2021) Currently, some policies and instruments with the aim to avoid this issue already exists. With tax incentives to technological companies and discounted office spaces the government tries to reduce early exits and starts building productions and capabilities to secure economic and technologic value in Israel. (Abraham, 2021; Rykower, 2021) In addition, the transfer of knowledge is subject to a sort of penalty payment due to state intervention. So, if the developed know-how is to be sold abroad, the exporter of the knowledge must repay up to six times the received subsidy. (Maris, 2021) To sum it up, one can say it is important that the government creates an enriched ecosystem so to speak a One-Stop-Shop that minimizes the risks and potential bureaucracy efforts for businesses. (Rykower, 2021)

5. Summary and Conclusion

Compared to other innovation ecosystems, Israel's NIS is a very mature and established system that has been in place for more than 20 years. It is very self-contained, characterized by strong networking and offers a high degree of opportunities. Due to a different risk culture – in the sense of risk-taking in everyday politics as well as in the start-up scene – the Israeli NIS is very flexible and, above all, able to adapt and find solutions within a very short time. Nevertheless, without the combination of industry with higher education, the educational system, the defense forces and especially the government nothing would have been established in Israel. For decades, the State of Israel encouraged technological entrepreneurship and investment in industrial R&D through various programs. However, through the success of the system new challenges have occurred. At present, Israel is facing major issues regarding human capital as well as knowledge spillover.

About the Authors

Deniz Gündogdu is a Master student in Business Administration at Offenburg University. He holds a Bachelor of Arts in Business Administration from Offenburg University.

Nico Metzner is a Master student in Business Administration at Offenburg University. He holds a Bachelor of Arts in Business Administration from Cooperative State University Mannheim.

Giuliano Nucaro is a Master student in Business Administration at Offenburg University. He holds a Bachelor of Arts in Business Administration from Heilbronn University.

Julia Seitz is a Master student in Business Administration at Offenburg University. She holds a Bachelor of Arts in Business Administration from Offenburg University.

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Appendix

Interview Guide - Interview 1

| | |
|--------------------|---|
| Contact: | Mrs. Nilli Shalev Mrs. Yael Koresh |
| Institution: | Israel Innovation Authority |
| Date of Interview: | 24.05.2021 |
| Time slot: | 15:00 – 15:30 |
| Participants: | Israel Innovation Authority Mrs. Nilli Shalev University of Offenburg Mr. Deniz Gündogdu Mr. Nico Metzner Mr. Giuliano Nucaro Ms. Julia Seitz |

1. How does Israel's innovation system look like and what are the specific actors?

- Many different players are involved and not all of them work as a system itself
- It is more like a general ecosystem than a "system"
- Due to shortage and necessity of production factors like natural resources or water and a hostile environment which had often conducted to embargos (political isolation)
- Israel needed to develop by itself and became a highly innovative place
- The ecosystem's main transition proceeded during the 90's when Israel adjusted from a traditional agricultural into a high-tech economy
- The ecosystem composes different actors
 - **Military Defense Forces** (The Military Defense Forces affecting related industries while on the other hand It creates qualified human capital and an abundance of innovation. At the age of 18 every Israeli goes to the army. Intelligence became an important unit in the Israeli army many young people get trained in these technologies and start developing them. This innovation will be used in military, but it is also relevant for civilian use → healthcare, finance or cyber securities (Knowledge-Spill-over)).
 - **Academia** (There are 8 big research Universities in Israel which are all well-established, have a good reputation and create a lot of innovation and knowledge.)
 - **Venture Capital** (Throughout the years Israel has developed a very robust Venture Capital Industry which is nowadays raising over 9 billion dollars annually to support high-tech start-up companies.)
 - **Multinational Companies** (Israel acquires every year up to 12 multinational companies that open R&D facilities which led to a total of over 400 multinational companies. *Upside*: knowledge, markets, innovations, investments etc. *Downside*: Competition on human capital which leads to a war of talents and extremely high salaries. Companies do not necessarily manufacture in Israel and the know-how drains to competitor countries.)
 - **Government** (From the early 70s the government established strong institutions like the IIA to incentivize the Israeli innovation. Throughout, the years it has become a very stable policy but of course during the growth of the ecosystem they were getting smaller and today most of the investments are private ones. The policy, the direction and the seed money still come from the government.)

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| <ul style="list-style-type: none"> • Startups (Entrepreneurial spirit is embedded in the culture. So many people want to develop and grow their own companies) <p>2. What are the main factors of a successful innovation policy like the one in Israel?</p> <ul style="list-style-type: none"> - Main factor is providing funding in areas where the private market does not fund because they may need more time to grow (e.g., life sciences or nanotechnology) - Never provide 100% of the funding, which should create stronger companies and innovations because the companies need to show that they are able to raise other funding's as well. - IIA shares the risk. For sure they ask for matching funding but if the company fails, they both fail and do not ask the money back. So, if the company succeed, they do ask back for the money. - When they are looking for supporting innovation, they want to see the technological excellence of the company. So how unique, new, and different it is. Second aspect is the capability of the team to execute the program and the third aspect is the commercial potential of the fund. Israel policy is operating under a law (R&D Law). The positive thing with it is that the policy or support is less influenced by political changes. It's the recognition of the government, that the R&D and Innovation are key factors of the economy. From our perspective 43% of the Israeli Export comes from high-tech which is the local motive, that pushes the economy forward. All together stability and clearance from the government are important elements. |
| <p>3. How does Israel's national innovation system distinguish it from other countries in the world in terms of a successful innovation culture?</p> <ul style="list-style-type: none"> - Throughout the years they established a bottom-up approach policy. So, they never said that they need to know where the market goes to or what the main topics for research and innovation are. So, they just said apply to us with solutions for specific problems. In general, they provide funding and set the rules to get one and you can come to us with any innovative idea you have. Now they are combining this policy with a top-down approach, but the work of the activities is still bottom up. That allows a very open and fruitful innovation ecosystem that everybody can think of their own ideas and be very creative. Nowadays nearly every country is driven by innovation. Especially in Israel this environment has established decades ago because they hadn't any other alternative in the past (political isolation, limited production factors). - Culture of error is completely different there and people are more aware of innovation. Israeli culture is informal, starting e.g., in school where students deal totally different with strictness etc. Also, hierarchy isn't very strong in Israel which led to everybody saying their opinion. What others have by discipline Israeli have by non-discipline. |
| <p>4. What fundamental changes or challenges do you see or expect in Israel in terms of innovation policies in the next 5-10 years and what could the government do to meet these obstacles and ensure innovation growth?</p> <ul style="list-style-type: none"> - Main challenge in Israel is human capital. This is the main barrier for growth of companies. There is a very high demand for human capital but no offer. Either by pushing local population to be involved in high-tech for example women, ultra-orthodox men or Arabs which are less in high-tech and more in pharmacy etc. - 20% of the Israel population are Arabs which are highly educated and have the capabilities to be strong work force for the high-tech sector but not going to the army, so they are not starting from the same point to be involved in high-tech. - 10% of Israel's population are ultra-orthodox which are only read the bible and don't go to work or participate in the work force. they are very smart people with a lot of analytical capabilities, but they are only use it for studying the bible. Further, they need to advance the value that stays in Israel (want to see more) and they need to make sure, although they are a bottom-up approach, to look closer on future technologies, trends and deal with them. |
| <p>5. What temps' global players like apple, google, Bosch etc. to locate in Israel?</p> |

Human capital, innovation, quality of engineers, the chutzpah, things you can archive in Israel in a lower price and very fast.

Interview Guide - Interview 2

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| Kontakt: | Herr Andreas Maris |
| Institution: | Israel Economic & Trade Mission Munich, Außenhandelsabteilung des Ministeriums für Wirtschaft und Industrie (FTA), Israel |
| Datum des Interviews: | 27.05.2021 |
| Uhrzeit: | 16:30 – 17:00 |
| Teilnehmer: | Israel Economic & Trade Mission Munich, Ministerium für Wirtschaft und Industrie Herr Andreas Maris Hochschule Offenburg Herr Deniz Gündogdu Herr Nico Metzner Herr Giuliano Nucaro Frau Julia Seitz |

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| <p>6. Wie sieht das Innovationssystem in Israel aus und welche speziellen Akteure gibt es?</p> <ul style="list-style-type: none"> - Drive der Unternehmer. Da es nur wenige große Konzerne/Unternehmen in Israel gibt streben viele junge Leute danach selbstständig zu werden (Staat allerdings sehr jung?) bzw. hat sich ein „Drive der Unternehmer“ im weiteren Sinne der Selbstverwirklichung entwickelt. - Fehlende Alternativen und intrinsische Motivation) - Venture Capital, NGO's (Startup Nation Central), Regierung |
| <p>7. Was sind die Erfolgsfaktoren einer erfolgreichen Innovationspolitik wie der in Israel?</p> <ul style="list-style-type: none"> - Israel Innovation Authority (Call für Inkubatoren: Ausländischen Firmen können sich im Bereich schwierige und kostenintensive Technologien bewerben und mit lokalen Startups forschen und entwickeln. Dabei werden 85% der Kosten übernommen. - Über 40 FTA Büros in allen größeren Märkten die israelische Unternehmen vor Ort unterstützen |
| <p>8. Was unterscheidet Israel im Hinblick auf eine erfolgreiche Innovationskultur von anderen Ländern der Welt?</p> <ul style="list-style-type: none"> - Mangel an Alternativen. Man kann sich kein einfaches Leben machen. Drive erfolgreich möglich schnell zu wachsen. Stattdessen: Erkenntnis, dass Wachstum auf globalen Märkten erfolgen muss, um nachhaltig zu wachsen und erfolgreich zu sein. - Keine besonders hohe Wirtschaftsmacht der umliegenden Länder, vor allem im Hinblick auf Import/Export aber auch Spill-Over) - Technologisches Know-How aus spezifischen Einheiten des Militärs - Netzwerke und Freundschaften die bei solch einem kleinen Land sehr viel wert sind. - Einwandererland. Gerade zu Beginn waren viele der Einwanderer intellektuelle |
| <p>9. Welche grundlegenden Veränderungen bzw. Herausforderungen sehen Sie für das Thema Innovationspolitik in den nächsten 5-10 Jahren?</p> |

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| <ul style="list-style-type: none"> - Wechsel von einer Startup Nation hin zu einer Scale-up Nation. D.h. weg von dem Gedanken, dass in Israel nur die Ideen entstehen und das Know-How dann abfließt (m&a) und Rahmenbedingungen schaffen, die es ermöglichen selbstständig organisch zu wachsen. - Außerdem ist es wichtig, dass mehr vor Ort produziert wird (auch im Hinblick auf Arbeitsplätze). - Problem dabei ist allerdings, dass v. A. asiatische Länder deutlich günstiger sind als Israel. | |
| 10. | <p>Was verleitet „Global Player“ wie Apple, Google, Bosch usw. in Israel ansässig zu werden?</p> <ul style="list-style-type: none"> - Delegationen, Unternehmerreisen etc. zwar gut geeignet, um Kontakte zu knüpfen, allerdings wird man nie so gute Kontakte haben, um gute Startups frühzeitig zu identifizieren. Andersrum profitieren aber auch die Startups von den Unternehmen, um am Ende vom Tage Produkte im großen Stil umzusetzen. - Kultureller Unterschied. Solang man nur im Heimatland forscht und entwickelt, besteht die Möglichkeit gewisse Trends zu verschlafen. |

Interview Guide - Interview 3

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| Contact: | Mr. David Abraham |
| Institution: | Robert Bosch, Central Research // Innovation Office Tel Aviv, Israel |
| Date of Interview: | 26.05.2021 |
| Time slot: | 13:30 – 15:00 |
| Participants: | <p>Innovation Office Tel Aviv</p> <p>Mr. David Abraha</p> <p>University of Offenburg</p> <p>Mr. Deniz Gündogdu</p> <p>Mr. Nico Metzner</p> <p>Mr. Giuliano Nucaro</p> <p>Ms. Julia Seitz</p> |

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| <p>1. How does Israel's innovation system look like and what are the specific actors?</p> <ul style="list-style-type: none"> - High-Tech is key sector in Israel (10% of employees, 15% of GDP and 50% of export) - There are also different ingredients that can be separated into Enablers and Drivers <p>- Academia</p> <ul style="list-style-type: none"> • Excellent scientific research • Graduate education • It is impossible to build a high-tech ecosystem without skilled people <p>- Government</p> <ul style="list-style-type: none"> • Favorable tax and labor policies • Financial support for Innovation • But lax intervention • Venture Capital Companies (last year close to 1B \$) • Local as well as active foreign presence (also cooperate VC's i.e., Bosch) • Angels provide seed funding and mentoring | |
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- CVC investment complement collaboration

- Multinational Companies (i.e., Intel)

- Develop management skills and build up scale
- Distribute knowledge and best practice
- Investing and later acquiring companies/startups
- Human resource (1/3 in MNC's)
- Typically, Startups built their capabilities on B2B and then go to the end market

- Military Service & Defense Industry

- Development of underlying Infrastructure
- Technology diffusion from defense industry
- People get exposed to work on technologies
- Networking

- Entrepreneurial culture (soft parameter)

- Informal and non-hierarchical mentality (tolerant to fails etc.)
- Sharing knowledge
- 2nd timers

2. What are the main factors of a successful innovation policy like the one in Israel?

- Government used to operate as a department of the ministry. Today they founded an Authority (IAA) which is more independent in supporting and promoting innovation.
- Supporting the late stages of academic research
- Supporting grants for the early stages of development in tech companies, reducing risk without diluting equity
- In the 90s the Government facilitated the creation of the Israeli VC industry, by attracting foreign capital and expertise
- Enables a favorable tax regime to technology companies
- Most importantly, it deliberately refrains from over intervention and guidance. Their philosophy is, that a government institution cannot understand the market as well as startups and companies.
- Different funds to support the ecosystems individual layers. For instance, single entrepreneurs, startups, R&D funds, funds for market research and analysis or money to set up incubators and accelerator programs)
- The IAA also tries to encourage emerging fields where the majority wouldn't invest
- Special law called ECA (Encouragement of capital investment in Israel)

3. How does Israel's national innovation system distinguish it from other countries in the world in terms of a successful innovation culture?

Culture

- We want to change the world
- Non-hierarchical and informal society
- Technology savvy and risk-taking culture
- Doubt conventional wisdom and challenge authority
- No penalty for risk-taking and its associated failures
- Altogether, very conducive to innovation

Immigration

- Israel is a country of immigrants from all over the world
- Every year continues to absorb a much higher percentage of new immigrants than almost any country in the world

- Immigrants bring with them a diversity of options, skills, and mindsets, creating an incredibly powerful ground of innovation

Military

- Military Service is mandatory for most people
- It plays an important role in the innovation ecosystem
- Providing training and experience in cutting edge technologies
- Young Israelis develop responsibility, discipline, leadership, and learn to focus on achieving goals, at their early 20s
- The military service also creates very strong social networks, which often later translate in to professional networks

4. What fundamental changes or challenges do you see or expect in Israel in terms of innovation policies in the next 5-10 years and what could the government do to meet these obstacles and ensure innovation growth?

- Many companies do research and development in Israel and then register the patent in the foreign country
- Israel needs to keep its edge and move on in the chain from a Startup Nation to a Scale up Nation. That means it is not enough to just build startups and then sell them to MNC. It is important to reduce early exits and start building manufacturing and capabilities in the country.
- Human capital. Israel needs more inclusive policies to include section of the population that are less high-tech players (women, ultra-orthodox man and Arabs). It's important that these groups participate more in the game.
- Since Israel is small country that hasn't any natural resources or enough financial and human capital to build up a giant industry, their competitive edge is built on knowledge. In order to strengthen this sector in a short and medium-term it is important to close the gap of human capital shortage.
- Also, it is a social point of view. If you want to have a strong society with minimal polarization, equal representation and everyone having their skin in the game, in a long term it is also important to build up a strong and integrated society.

5. What temps' global players like apple, google, Bosch etc. to locate in Israel?

Israel is a verry strong player in ICT (Information, Communication and Technology) and its capabilities

Interview Guide – Interview 4

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| Kontakt: | Herr Manfred Tilz |
| Institution: | Germany Trade Invest |
| Datum des Interviews: | 31.05.2021 |
| Uhrzeit: | 15:00 – 15:30 Uhr |
| Teilnehmer: | Germany Trade Invest Mr. Manfred Tilz University of Offenburg Mr. Deniz Gündogdu Mr. Nico Metzner Mr. Giuliano Nucaro Ms. Julia Seitz |

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| 1. Wie sieht das Innovationssystem in Israel aus und welche speziellen Akteure gibt es? <ul style="list-style-type: none"> - Unternehmen, Universitäten, Militär, VC's, Inkubatoren, Acceleratoren, Business Angels und Regierung - Israel legt sehr viel Wert auf Innovation bzw. Innovationsförderung. Prozentsatz für F&E am BIP ist einer der höchsten weltweit (ca. 5%) - Innovation Authority bietet insbesondere für Seed Stage zentralen Förderrahmen (z.B. Tnufa Unterstützung von Projekten, wenn diese technisch und kommerziell sinnvoll sind). Zudem unterstützt Authority vor allem die Bereiche die von privaten Investoren vernachlässigt werden. (Technologische Bedeutung und kommerziell umsetzbar) - Inkubatorenprogramme (insg. 19 Inkubatoren) → Finanzielle Starthilfe bis Projekt gewisse Investitionsreife hat, auch administrative Beratung, Vernetzung (ca. 2 Jahre) - Acceleratoren (90) die von israelischen, ausländischen und NGO's betrieben werden - VC's übernehmen besonders wichtige Rolle innerhalb Startup Finanzierung. IVC Research Venture Capitals mit über 1,7 Mrd.\$ (2017). 1/3 der israelischen High-Tech Firmen entstehen aus VC's heraus - Business Angels (2017 Gesetz novelliert, dass den Investoren mehr Sicherheit verleiht und Investitionen können steuerlich geltend gemacht werden) - Crowd Founding wie z.B. Our Crowd |
| 2. Was sind die Erfolgsfaktoren einer erfolgreichen Innovationspolitik wie der in Israel? <p>-</p> |
| 3. Was unterscheidet Israel im Hinblick auf eine erfolgreiche Innovationskultur von anderen Ländern der Welt? <ul style="list-style-type: none"> - Universitäten aktiv an Entwicklung von Innovation beteiligt. Eigene Kommerzialisierungsgesellschaften, die ganz eng mit der Wirtschaft zusammenarbeiten - Viele Junge Menschen sammeln in den Technologieeinheiten der Armee wichtige Erfahrungen, die anderen Ländern so nicht machen können. Kombination aus Armeeerfahrung und später Hochschulausbildung ist eine der größten Stärken des israelischen Innovationssystem. Außerdem entsteht in dieser Zeit ein informelles Netzwerk. - Geschäftskultur ist eine andere. Nicht so förmlich und hierarchisch |

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| <p>4. Welche grundlegenden Veränderungen bzw. Herausforderungen sehen Sie für das Thema Innovationspolitik in den nächsten 5-10 Jahren?</p> <ul style="list-style-type: none"> - Erwartet keine grundlegenden Veränderungen der Innovationspolitik. F&E ist ja Markenzeichen der israelischen Wirtschaft und dass hier drauf sehr viel Wert gelegt wird. Sehen sich als Werkbank für internationale Unternehmen. Israel als Startup Werk der globalen Wirtschaft. Daran wird sich nichts ändern. Im Gegensatz wird eher weiter gefördert. - Humankapital (Fachkräfte wandern zum Teil auch ab „Braindrain“ daher ist es wichtig Anreize zu schaffen, dass die Leute im Land bleiben, was gerade auch mit der Unterstützung von kleinen Startups zusammenhängt) - Von Startup zu Scale-up Nation (Man muss schauen was möglich ist. Sicherlich nicht möglich alles herzustellen in Israel herzustellen) |
| <p>5. Was verleitet „Global Player“ wie Apple, Google, Bosch usw. in Israel ansässig zu werden?</p> <ul style="list-style-type: none"> - Exits sind groß im Trend - Israel bietet herausragende Vorteile für Unternehmen gerade was Unterstützung etc. angeht nicht nur monetär, sondern auch durch die Acceleratoren und Inkubatoren. Ähnlich wie in USA Silikon Vady - Fehlerkultur völlig anders als in Deutschland. Wenn man scheitert, gibt man nicht auf sondern nimmt sich neues Projekt und lernt aus dem Fehler |

Interview Guide – Interview 5

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| Kontakt: | Frau Charme Rykower |
| Institution: | Deutsch-Israelische Außenhandelskammer |
| Datum des Interviews: | 01.06.2021 |
| Uhrzeit: | 13:00 – 13:30 Uhr |
| Teilnehmer: | <p>Deutsch-Israelische Außenhandelskammer</p> <p>Frau Charme Rykower</p> <p>Hochschule Offenburg</p> <p>Herr Deniz Gündogdu</p> <p>Herr Nico Metzner</p> <p>Herr Giuliano Nucaro</p> <p>Frau Julia Seitz</p> |

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| <p>1. Wie sieht das Innovationssystem in Israel aus und welche speziellen Akteure gibt es?</p> <ul style="list-style-type: none"> - Sieht im Großen und Ganzen aus wie jedes andere Ökosystem auch. Neben einer breiten Schicht an Startups (ca. 9500), gibt es viele Inkubatoren (davon 20 staatlich gefördert, d.h. 85% staatlich und 15% privat finanziert). Jeder Inkubator ist auf eine spezielle Branche ausgelegt und bezieht meistens international Tätige Akteure mit ein. - Außerdem gibt es Acceleratoren (mehrere hunderte) die mehr auf Mentoring und Programme abzielen und privatwirtschaftlich betrieben sind (Google, IBM, LG usw.) - Nicht zu vergessen sind die Investoren. Dazu gehören sowohl Business Angels sowie VC's, aber auch Corporate VCs (weltweit höchste Dichte an VC Kapital/Kopf). - Dazu kommen über 350 Multi Nationale Konzerne, die in Israel F&E Einrichtungen betreiben. |
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| <ul style="list-style-type: none"> - Staat/Regierung als wichtiges Fundament. Geht zahlenmäßig ein Stück weit unter ist aber seit den 70er stark involviert, das Ökosystem voranzutreiben. Dazu zählen verschiedenste Programme, Launches und Calls for Cooperations (ähnlich wie Horizon Programme). Staat agiert durch die Israel Innovation Authority. Z.B. wird jetzt einer der Inkubatoren der IIA bespielt von Merk, Pfizer und Astrazeneca. - Militär. Allerdings eher am Rande und nicht als Teil des Ökosystems. Eher einer der Motoren in Form einer technologischen Ausbildungsstätte. Lässt außerdem soziale Durchmischung zu, bei der die Menschen aus egal welcher Schicht bzw. Herkunft eine technologische Ausbildung erhalten. (Umweltfaktoren) |
| <p>2. Was sind die Erfolgsfaktoren einer erfolgreichen Innovationspolitik wie der in Israel?</p> <ul style="list-style-type: none"> - Inkubatoren Zentren gründen sich auf die Mitte der 90er vom Start gelunchte Yozma (hebr. für Initiative). Israel ist ein Einwanderungsland und jedes Mal, wenn es irgendwo Pogrome gab kamen neue Flüchtlinge. In den 90er waren das vor allem Juden aus Russland die im Gegensatz zu anderen Gruppen besonders gut ausgebildet waren (Ingenieure, Akademiker etc.) aber zunächst keine Arbeit hatten. Daraufhin hat der Staat 100 Millionen \$ investiert und Netzwerk mit Geopolitik kombiniert und verschiedene Stellen geschaffen, aus denen heraus sich dann die späteren Inkubatoren entwickelt haben. - Davon abgesehen ist der Staat sehr daran interessiert verschiedene Richtlinien vorzugeben (z.B. View Point Initiative des Prime Ministers). |
| <p>3. Was unterscheidet Israel im Hinblick auf eine erfolgreiche Innovationskultur von anderen Ländern der Welt?</p> <ul style="list-style-type: none"> - Im Vergleich zum deutschen Innovations-Ökosystem handelt es sich in Israel um ein sehr reifes und erprobtes System, dass seit mehr als 20 Jahren besteht. Es ist sehr in sich geschlossen und durch eine starke Vernetzung geprägt. Des Weiteren handelt es sich um ein sehr chancengleiches System. D. h man hilft sich und hat durch die starke Vernetzung Interesse daran andere Leute weiterzuempfehlen. - Andere Risikokultur im Sinne von sehr risikoerprobt und das sowohl im politischen Alltag als auch in der Gründerszene. Scheitern ist nicht negativ behaftet, sondern als Anhäufung von Erfahrungen (auch von Investoren gern gesehen) - Flache Hierarchien. Innovationssystem sonst nicht möglich, wenn der Staat nichts zulässt - Israelis leben im hier und jetzt (kein deutsches landzeitstrategisches Denken) und sind Weltmeister im jetzt sofort die Lösungen finden. Das führt zwar ein Stück weit zu einer gewissen Unruh aber ist gleichzeitig auch ein starker Antrieb (z.B. Chutzpah). - Gesundes Selbstbewusstsein, das vor allem in der Gründerkultur mehr Vor- als Nachteil ist. - Durch Migration entsteht Diversität, das neue Idee und mehr hervorbringt. - Israelische Mindset: Mission Impossible gibt es nicht. Alles ist möglich. |
| <p>4. Welche grundlegenden Veränderungen bzw. Herausforderungen sehen Sie für das Thema Innovationspolitik in den nächsten 5-10 Jahren?</p> <ul style="list-style-type: none"> - Wichtigste Herausforderung ist Human Kapital. Durch die vielen MNCs entsteht ein Krieg um Köpfe. Problem dabei ist, das MNCs hohe Gehälter zahlen, die sich kleine Startups nicht leisten können. Demnach versucht man inzwischen zwei Bevölkerungsgruppen stärker in das Ökosystem zu integrieren. Das sind vor allem die arabischen Israelis und die religiösen Frauen. Sowohl staatliche Förderungen als auch viele private Initiativen, um diese Personengruppen stärker zu integrieren. - Akademie weitere digital zu pushen und die Ausbildungsthemen zu erweitern. - Weiter stellt die Verteilungsfrage ein großes Problem dar. Und zwar stellt sich die zum Thema Exit die Frage, wie findet eine gerechte Umverteilung des Kapitals aber auch des Know-how statt. Einerseits das, dass IP im Land bleibt und andererseits Sicherstellen das Reichtum (Patent, Weiterentwicklung |

etc.) nicht nur bei einem ganz kleinen Prozentsatz ankommt und in Tel Aviv bleibt und wie kann man es schaffen, dass das Geld reinvestiert wird und Innovation weiter angetrieben wird.

- Mehr Skalieren
- Anreize sind aus staatlicher Sicht die Schaffung eines enriched Ökosystems, quasi the One-Stop-Shop. D.h. wenn du hierherkommst, kriegst du alles. Dazu zählen auch steuerliche Vorteile.

5. Was verleitet „Global Player“ wie Apple, Google, Bosch usw. in Israel ansässig zu werden?

- One-Stop-Shop
- Its a vibrant ecosystem und man kann es sich heute nicht mehr erlauben nicht hier zu sein und man erkennt, was für bahnbrechende Technologien in der Vergangenheit hier entstanden sind.
- Liegt geografisch günstig
- Trends im südostasiatischen Raum nicht verpassen aber auch Austausch mit Asien, China und Indien