ROLE OF TECHNOLOGY TRANSFER CATALYSTS IN STIMULATING INNOVATION: HOW TO APPLY FINNISH EXPERIENCE TO EMERGING ECONOMIES

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Abstract

Emerging economies view economic growth based on innovation as an important condition of ensuring sustainable growth in the 21st century. In light of this, governments of developing economies have adopted state programs on stimulating innovation among small and medium businesses. The government of Azerbaijan has made it a priority to develop new technology based firms (NTBF). The Development Concept of Azerbaijan Republic approved by the President in 2012, "Azerbaijan 2020: Look into the Future" emphasizes the establishment of market infrastructure network that serves to develop the non-oil sector. In this context, it is critical to study the national innovation policies and technology transfer systems of developed countries and modify it for the economy of Azerbaijan in order to stimulate innovative activeness in Azerbaijan. In this paper, experience of one of the leading countries in the field of technology transfer, namely Finland, is analyzed. The research mainly uses qualitative data obtained using the methodology of in-depth-interviews (IDI) with representatives of private sector, a public research centers, start-up accelerators and universities in Finland. Azerbaijan ecosystem for innovative entrepreneurship has also been analyzed based on IDIs conducted at start-up incubators and accelerators in Baku as well as using Delphi technique in a discussion which was attended by managers of Azerbaijani incubators and accelerators. Recommendations on how to apply Finnish experience in Azerbaijan are given in the conclusion of the paper.

Key world: emerging economies, economic growth, stimulating innovation, national innovation policies, technology transfer**.**

JEL classification: O31, O32, Q55

1. Introduction and methodology

Emerging economies in the post soviet region view economic growth based on innovation as an important condition of ensuring sustainable growth in the 21st century. In light of this, governments of developing economies have adopted state programs on stimulating innovation among small and medium businesses. The government of Azerbaijan is trying to develop new technology based firms (NTBF). The Development Concept of Azerbaijan Republic approved by the President in 2012, "Azerbaijan 2020: Look Into the Future" emphasizes the establishment of market infrastructure network that serves to develop the non-oil sector. According to findings of a study conducted by the World Bank in 2013, only 12 percent of businesses in Azerbaijan which participated in the study indicated that they have introduced new or substantially improved product or service in the past three years (Smita, 2013). This shows a need for a system which encourages more innovative activity among small and medium businesses. One way to succeed in developing the non-oil sector is supporting innovative entrepreneurship.

Since the government of Azerbaijan views moving away from an economy based on natural resources to an economy based on innovative entrepreneurship as one of the high priority tasks, there is a need to study international experience in this field to develop proposals for policy makers. Although there are arguments against using the experience of developed countries in formulating strategies for emerging economies, there is evidence in favor of a "follow the leader approach" (Rostow, 1960), i.e. that emerging economies should adopt the models and follow the recipes of developed countries. In light of this, it is critical to study the national innovation policies and technology transfer systems of developed countries and modify it for the economy of Azerbaijan in order to stimulate innovative activeness in Azerbaijan. In this paper, the experience of one of the leading countries in the field of technology transfer, namely Finland, is analyzed.

Methodology

The author has conducted in-depth-interviews with representatives of private sector, universities, start-up accelerator and a public research center in Finland. Azerbaijan ecosystem for innovative entrepreneurship has also been analyzed based on IDIs conducted at start-up incubators and accelerators in Baku as well as using Delphi technique in a discussion which was attended by managers of Azerbaijani incubators and accelerators. The results of the analysis of qualitative data is used to derive proposals for emerging economis like Azerbaijan. Section II of the paper includes literature review on the topic of innovation and technology transfer. Section III discusses the innovative ventures ecosystem in Azerbaijan. Section IV analyzes the Finnish experience of technology transfer from universities to industry, with a

focus on the three players of Finnish technology transfer system – universities, public research centers and private companies. Recommendations are included in the conclusion.

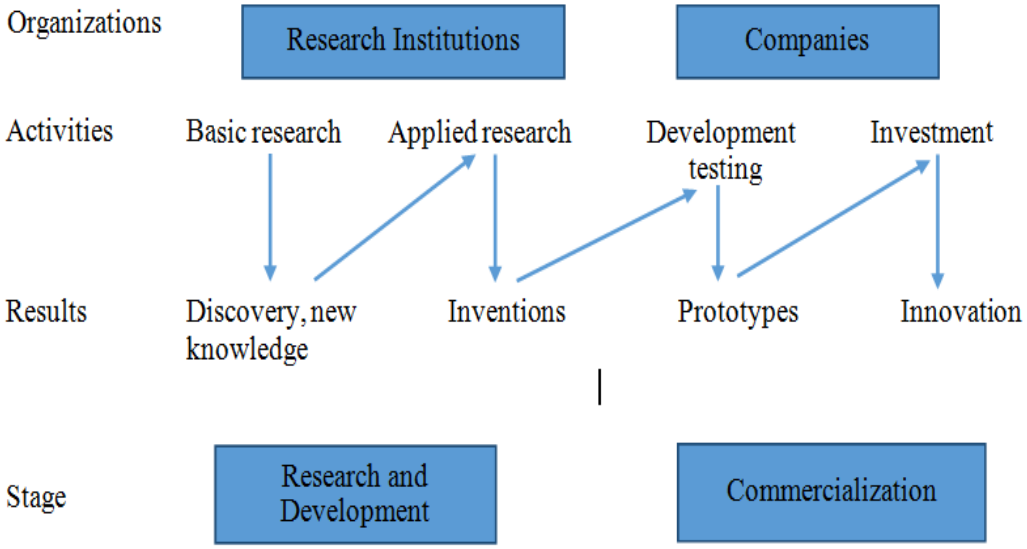
2. Literature Review

Over the past decade, both academic scholars and policy makers have focused on the role that technological innovation plays in economic growth. OECD defines innovation as the implementation of a new or a significantly improved product (good or service) or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations of a company. The major features are that innovation: 1) is associated with uncertainty over the outcome of innovation activities; 2) involves investment; 3) is subject to spill-over; 4) involves the utilization of new knowledge, or a new combination of existing knowledge; 5) aims at improving the firm's performance by gaining a competitive advantage by shifting the demand curve for the firm's products (United Nations Economic Commission for Europe, 2012).

The process of innovation consists of a number of stages starting from the inventions resulting from labaratories and ending with the new products and processes appearing on the market. This process involves several organizations, which enable the commercialization of innovation to occur. The major stages and actors involved in the innovation process are presented schematically in graph 1 and graph 2. While graph 1 illustrates a traditional ("linear") model of innovation and commercialization, graph 2 highlights an interactive approach to the process of innovation and commercialization. As it can be seen, from graph 1, research institutions and companies are involved in the innovation process. Main activities involved in this process are conducting basic and applied research, testing the results of inventions (development testing) and investing needed capital to take the results of inventions to the market. This entire process results in new products or processes, and called innovation. Basic research conducted at universities and research institutions result in discoveries and new knowledge.

Applied research which is based on the results of basic research ends with inventions. Inventions of research institutions are often developed into prototypes by companies. Companies invest funds on development testing, creating prototypes and on working capital into order to take the innovation to the market. It must be noted that the first two activities (basic and applied research), which are referred to as "research and development stage" are performed by universities, research institutions as well research and development departments of companies. The third and fourth activities (development testing and investing), which is referred to as "commercialization stage" are performed by companies.

Exhibit 2.1 Innovation process -Activities of organizations involved and stages



Source: C. Greenhalgh and M. Rogers, Innovation, Intellectual Property and Economic Growth (Princeton University Press, 2010), p. 97.

The main participants of the process of the commercialization of R&D results are summarized in graph 3. The main factors in commercialization include factors such as:

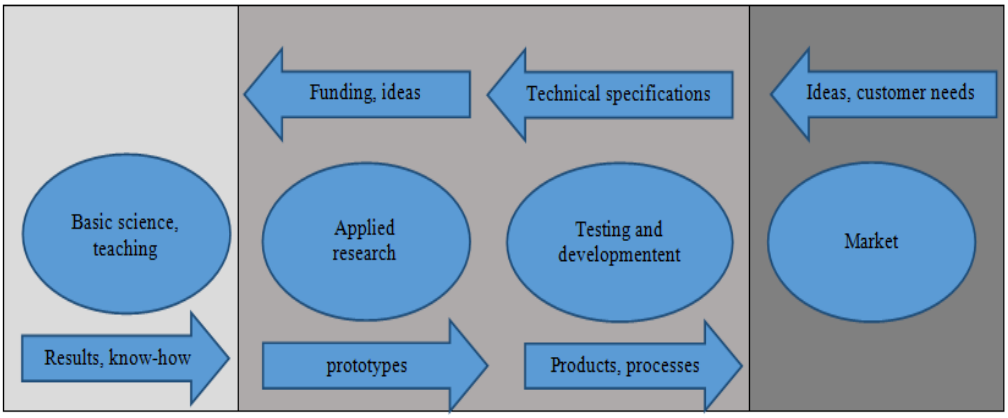
1. The level of Research and Development, which is measured by the stock of inventions and innovations to be commercialized. Among other factors, the level of R&D depends on the number of universities and research institutions in the country, the number and qualifications of research workers in research organizations and the business sector, investment in R&D from public and private sources and its effectiveness.

2. Human resources available for R&D. The availability of highly qualified researchers depends on the quality of education, especially at university level. The quality of education, in turn, is determined by the funds allocated to education by the state, enrolment rates in universities and the quality of education at these universities.

3. Regulatory and institutional environment that supports innovation which means transparency and accountability in public spending and investment, stable property rights including intellectual property rights, transparent and stable laws, low costs and simple procedures governing the registration and operation of enterprises. Additionally, innovation is supported when legislation makes it easy and less costly to hire workers and register intellectual property, transparent tax

administration and reasonable taxation rates, and ease of access to finance at various stages of enterprise development, as well as creating favorable conditions for foreign enterprises which are interested in investing in the country, including in R&D. These factors influence the business climate in which the innovation-based enterprises operate, and thus determine the demand for innovation.

Exhibit 2.2 Innovative process:interaction of major actors and processes



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- Universities and research organizations

-SMEs and big firms

- Customers

Source: Report of the United Nations Economic Commission for Europe (2012) "Fostering Innovative Entrepreneurship"

4. The intensity of ties between the various participants involved in innovation. These links are provided by public and private organizations that support entrepreneurs in establishing spin-off companies, commercializing their innovations and bringing them to the market (Exhibit 2.2).

5. Openness to foreign technologies and to international cooperation in innovation. Research and development is effective when it is carried out across national borders and the national capacity to absorb and adapt technologies developed worldwide is one of the key drivers of innovation. By participating in international R&D networks and technology transfer, countries can also get access to the knowledge accumulated abroad as well as foreign sources of innovation finance and investment, and can increase the speed and quality of their own innovation.

6. Wide use of information and communication technology (ICT). Well developed internet and mobile phone networks both provide support for enterprises and create a business environment which is more supportive to entrepreneurship.

Moreover, they are important for enabling domestic research organizations and firms to tap into knowledge generated abroad and to cooperate internationally in R&D and commercialization (United Nations Economic Commission for Europe report on Fostering Innovative Entrepreneurship, 2012).

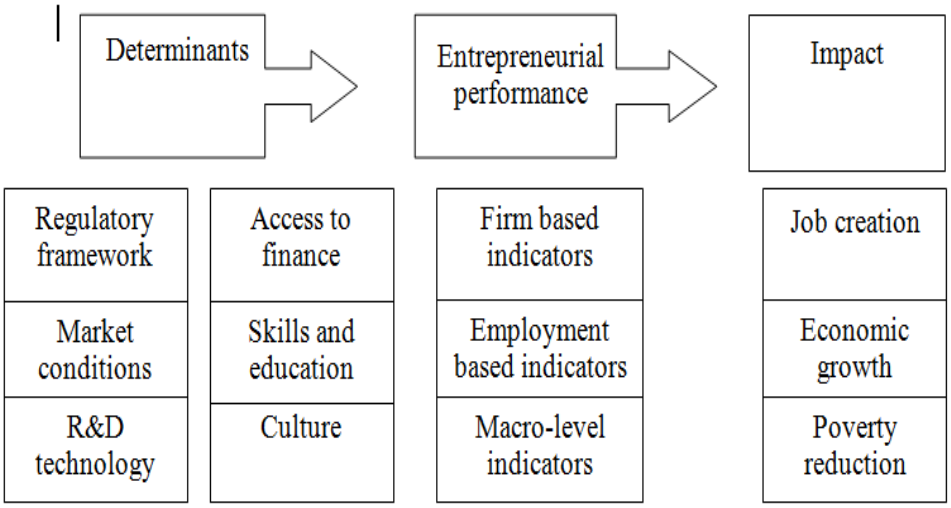
3. Innovation and Technology Transfer System in Azerbaijan

Emerging economies in the post soviet region view economic growth based on innovation as an important condition of ensuring sustainable growth in the 21st century. In light of this, governments of developing economies have adopted state programs on stimulating innovation among small and medium businesses. The government of Azerbaijan is trying to develop new technology based firms (NTBF). According to findings of a study conducted by the World Bank in 2013, only 12 percent of businesses in Azerbaijan which participated in the study indicated that they have introduced new or substantially improved product or service in the past three years (Kuriakose, Smita, 2013). This shows a need for a system which encourages more innovative activity among small and medium businesses.

One way to succeed in developing the non-oil sector is supporting innovative entrepreneurship. The Development Concept of Azerbaijan Republic approved by the President in 2012, "Azerbaijan 2020: Look Into the Future" emphasizes the establishment of market infrastructure network that serves to develop the non-oil sector. For instance, Ministry of Information and Communication Technology has recently launched two projects: Regional Innovation Zone and High-Tech Park. High-Tech Park of Azerbaijan was established in 2012 to serve as a seedbed for new technology based startups. It currently serves as a business incubator and provides organizational and some financial support to startups. The government of Azerbaijan is planning to expand this project by building a High-Tech City in capital city Baku.

Developing economies like Azerbaijan are trying to establish an environment supportive of innovation and technology transfer. This requires establishing a legal framework and financial infrastructure for effective functioning of technology transfer mechanisms. To speed up the transfer of technology and innovation it is important to create an ecosystem which supports innovative entrepreneurship. Because, like other determinants of entrepreneurial performance, regulatory (legal) framework impacts the development of innovative entrepreneurship (Exhibit 3.1). Legal systems which shorten bureaucratic procedures associated with registration of businesses, licensing, simplified taxation help foster innovative entrepreneurship. Moreover, strong competitive environment act as a stimulus to innovation based entrepreneurship.

Exhibit 3.1: Entrepreneurship model



Source: "Kuriakose, Smita. 2013. Fostering Entrepreneurship in Azerbaijan. Direction in Development-Private Sector Development;. Washington, DC: World Bank

There have been improvements in the process of registration of entrepreneurs, customs declaration and other similar processes through the establishment of State Agency for Public Service and Social Innovations (ASAN). Despite the improvements in the legal environment, there is a need to strengthen the competitive environment both in the product and factor market. Unlike in other CIS countries, in Azerbaijan there is not an independent state agency which enforces legislation on competition. Without such an agency it is hard to enforce antimonopoly legislation effectively. In addition to enforcement of legislation on competition, enforcement of intellectual property rights legislation must also be viewed as a priority in order to stimulate innovative entrepreneurship.

Researchers are in consensus regarding the impact of the amount of investment in R&D activities on a company's innovative capacity. Usually, companies that spend more resources on R&D are more innovative than those that do not spend resources on R&D. Analysis of the R&D activities of Azerbaijani companies shows that gross expenditures on R&D have increased in Azerbaijan between 2008 and 2011, however the share of these expenditures financed by the business sector has decreased. Besides the amount invested in R&D, as table 3.1 shows, the number of organizations undertaking R&D has also declined between

2008 and 2011. The gross expenditures on research and development is relatively stable at an average rate of 0.2% of GDP.

Table 3.1: R&D expenditures in Azerbaijan between 2008 and 2011

	2008	2009	2010	2011
Gross expenditures on research and development, million manat	67.0	89.2	93.4	111.1
Of which: financed by the public sector, %	77.1	78.0	80.6	82.2
Financed by the business sector, %	22.9	22.0	19.4	17.8
Gross expenditures on research and development, % of GDP	0.18	0.25	0.22	0.22
Public expenditures on R&D, % of total public expenditure	0.6	0.8	0.8	0.7
Number of organizations undertaking R&D	146	148	145	143
Number of employed persons engaged in R&D	17942	17401	17924	18687

Source: World Bank (www.data.worldbank.org)

One more important factor in developing innovation is creating an ecosystem for new technology based start-ups. Business incubation is designed to support the foundation and growth of a new technology based company. Business incubator can be privately or publicly owned, and provide physical space and a number of services to start-ups, helping them through the earlier stages of their development. Azerbaijan has launched some initiatives in establishing an ecosystem that supports technology based startups. Some projects intended to stimulate innovative entrepreneurship have been launched by businesses, government agencies and universities. There are currently ten incubators in Azerbaijan – three of them private, one established by the government, and three incubators opened by universities and two incubators initiated by telecom companies – Azercell and Bakcell. It is encouraging to see that in addition to government, academic institutions as well as private sector have also been actively contributing to establishing an ecosystem that supports technology entrepreneurship. Description of the incubators/accelerators initiated by government and private sector is given below. The information was gathered based on in-depth-interview (IDI) with managers of these incubators.

Azercell incubation program named Barama Innovation and Entrepreneurship Center is designed for up to 18 months which includes the following 6 steps, each of which lasts 3 months:

Conception stage - In this steps startups admitted to Barama Innovation and

Entrepreneurship Center must finish forming teams and finish working on the concept. Mentorship by Barama's administration is provided in this stage in addition to support from Azercell experts.

Prototype stage – In the prototype stage, teams must work on the prototype of the product. Azercell's software engineers can help the teams to develop the prototype. Creating the prototype is very important to team because until prototype is completed, no funding is given. Teams with ready prototype and strong teams may receive seed capital from Barama Innovation and Entrepreneurship Center.

Commercializing stage – at the commercialization stage, startup teams are expected to prepare the product for the market. In this stage, market research is expected to be completed by the team to make final adjustments to the product before it is introduced to the market.

Execution stage – startup team plans and manages all the operations related activities. At this stage teams are supported by Azercell, so they can be ready to launch their product successfully at the next stage. Azercell, supports startups through its own experts as well as other entities in its network.

Launch stage – at this stage, teams launch their products and enter the market. Here, Azercell uses its network to help startups reach its customers. During the launch stage, startups can also benefit from media exposure with Azercell's support which is key in this stage.

Graduation stage – successful teams which have launched their products to the market leave the incubation program of Barama Innovation and Entrepreneurship Center.

Government of Azerbaijan also takes active part in establishing an ecosystem that supports technology based startups. One of such initiatives was High-Tech Park of Azerbaijan, which was established in 2012 under the Ministry of High Technology and Communication to serve as a seedbed for new technology based startups. It currently serves as a business incubator and provides legal and accounting support to startups. **"High Tech Park Azerbaijan" (HTP)** was launched in 2012 through the Decree of the President of the Republic of Azerbaijan. Main goal of HTP is the development of a sustainable and competitive environment for the high tech economy in Azerbaijan. Business Incubation Center of HTP is a pilot startup incubator of High Tech Park. Center started operations in February 2014 with induction of its first cohort of startup companies. Since its opening, 70 teams have been admitted to HTP. Currently there are 26 teams at the incubator of HTP. In addition to startups, HTP also houses five resident companies from the technology sector. Teams admitted to HTP Business Incubation Center can benefit from mentorship as well as legal, accounting and HR support provided by the

administration of HTP. HTP also facilitates networking opportunity for startups and resident firms as well as entrepreneurs, investors and international experts who are invited as guest speakers to HTP.

Although HTP does not offer any form of financing to startups, it helps founders to find and engage with investors locally and internationally by supporting their trips to pitch days internationally. Some of the startups at HTP have received investments to develop alpha and beta products. Founders have also received grants through ICT Fund of the Ministry of Communications and High Technologies of Azerbaijan. Success cases of startups from HTP include Nuush.az (an online food ordering service), Code Academy (coding bootcamp), Neuron Technologies (provides ICT based innovative solutions), Bilikli.net (online test preparation service). Moreover, internationally known startup company WeTravel (wetravel.to) is managed from Silicon Valley, but much of its development takes place at HTP.

QU Techno Park was founded by Qafqaz University in 2013. In addition to startups, it houses around 10 residents. It admits new cohorts of startups once a year through "New Idea Competition" which was launched in 2013. It was the first incubation center established at a university. Qafqaz University supports winners of the competition by providing seed capital , and other resources like office, internet, and laptop for one year with no stake in return. Mentorship and training schemes consists of trainings and seminars on entrepreneurship and innovation by both local and international experts. Resident firms also provide mentorship and exchange experience at all possible circumstances. When startup proves to evolve into a new firm they also receive help to raise additional funds and access to the necessary network to start operating in the market. New Idea Competition admitted 22 projects to the incubation center out of 410 applications since its foundation. A number of successful startups like Emedia (provides experts' video answers to the questions), BethClip (synchronizing clipboard with multiple devices, enabling you to have access to the same data) already have started selling their services.

Next Step Innovation Center: Founded by three entrepreneurs, Next Step is a private incubator that invests in new technology ideas. The founders of Next Step include three established businessmen in Azerbaijan. Given their significant business experience, the founders bring valuable experience to the accelerator. Next Step has recruited two mentors – serial entrepreneurs with experience in Silicon Valley. The accelerator started operating in 2015 and has selected 5 teams to its accelerator program. New cohorts are admitted three times a year. Applicant teams must fill out an online application. Selected teams are invited for a pitch and successful teams are invited for an interview with the mentors. Teams are not required to submit business plans.

Teams chosen for Next Step are offered a free office space, laptops and seed capital in the amount of 2000 AZN monthly. In return, Next Step asks for an equity share in the range of 3-9%. The accelerator also provides legal support to founders – to register the business as well as in applying for patents. Mentors work with teams on a weekly basis and monitor progress. At the end of three month incubation period, graduating teams pitch to investors on Demo Day. Next Step is open for both software and hardware based startups. One of the startups housed at Next Step, "Ustam" has started generating traction and has registered as a legal person.

Baku Business Factory is a private accelerator started operating in 2015. Baku Business Factory (BBF) provides free space and mentoring for startups. Applications to BBF take place on rolling bases. Online applications go through an initial screening. Promising applications are invited for an interview and those who pass the interview stage are admitted to the accelerator. Although all admitted teams can benefit from the resources and network of BBF, not all of them receive seed capital. Teams interested in receiving investment need to develop a business plan and pitch their business idea in front of the BBF management team. Currently there are 19 teams in the BBF incubator. Some of the successful startups include BrandCream (offers exclusive way of brand promotions in the public) and Keepface (social influencer marketing company) which have started generating cash flow. All of the startups housed at BBF can benefit from media exposure.

Sup.az is another private accelerator which started operating in 2015. It selects teams to its accelerator three times a year. Teams apply online and selected teams are invited to present their business plans to the management and judges of Sup.az. Selected teams go through 4 months of incubation or acceleration period. At the end of the 4 months, teams present their products on Demo Day, which is attended by local and international investors as well as other startup teams. During their stay at Sup.az, teams are provided with free office and mentorship of local and international experts from the fields of product development and marketing. Moreover, team can benefit trainings and workshops on different topics which are important for startups' success. Managers of Sup.az also help admitted startups with PR and marketing by featuring their products at different events, on social media and on national media.

AppLab was opened in 2014 by Bakcell, the first mobile operator and the leading mobile internet provider of Azerbaijan. The program is aimed to provide effective tools to entrepreneurs and application developers to help accelerate their ideas and create innovative mobile applications for Azerbaijani and international markets (applab.bakcell.com). Unlike Barama İnnovasiya və Sahibkarlıq Mərkəzi, established by another mobile operator Azercell, which is designed for 18 months,

AppLab incubation program lasts only 3 months and specializes only on mobile applications. Another difference between Barama Incubation Program of Azercell and AppLab Program of Bakcell is that AppLab does not invest any capital in any of the stages. AppLab offers support as a corporate social responsbility and doesn't own any share in the startups that graduate from AppLab. Teams can apply online and selection takes place about once a month. After screening applicants, AppLab invites selected teams to pitch their business ideas. In addition to 30 minute presentation, teams are also required to submit an action plan for 3 months. No business plan is required from the teams.

Table 3.2: Incubators and accelerators in Azerbaijan

Name	Founder	Year Founded	Field of startups	Investment	Equity/revenue sharing
Barama	Azercell	2009		Seed capital to selected startups	Revenue sharing
HighTechPark (HTP)	Government (Ministry)	2012	webapp, mobile app	No investment	No equity sharing
QU Technopark	Qafqaz University	2013		Seed capital to all startups	No equity sharing
AppLab	Bakcell		Mobile app	No investment	No equity sharing
Baku Business Factory	Private	2015	Web/mobileapp	Seed capital to selected startups	Equity sharing
NextStep	Private	2015	Web/mobile app	Monthly stipend	Equity sharing
Sup.az	Private	2015	Web/mobile app	Seed capital to selected startups	Equity sharing

Source: prepared by the author based on interviews with founders of incubators

Teams which are admitted to AppLab are provided with free office, computers as well as mentorship during the incubation period. Bakcell's experts from Marketing, Finance departments as well as software engineers work closely with the teams. Bakcell's mentors also include local and international entrepreneurs with significant experience. Although AppLab doesn't invest any capital in startups, it helps to attract investments to startups by organizing events during which startups can pitch their business ideas to local and international investors. One of such prograsm were organized in partnership with Wayra, startup accelerator of a Spanish Telecom Company Telefonica in 2016. In this event Azerbaijani startup teams pitched their business ideas to representatives of Telefonica. AppLab hosts up to 7 startup teams at a time. During the 3 months of incubation period, AppLab admnistration and mentors monitor the progress of the teams to ensure that startups

are working in accordance with their action plan and to make sure that they can complete their product on time and introduce it to the market as planned. Two of the best startups that have graduated from AppLab incubation program are Bethclip and Xercim.az.

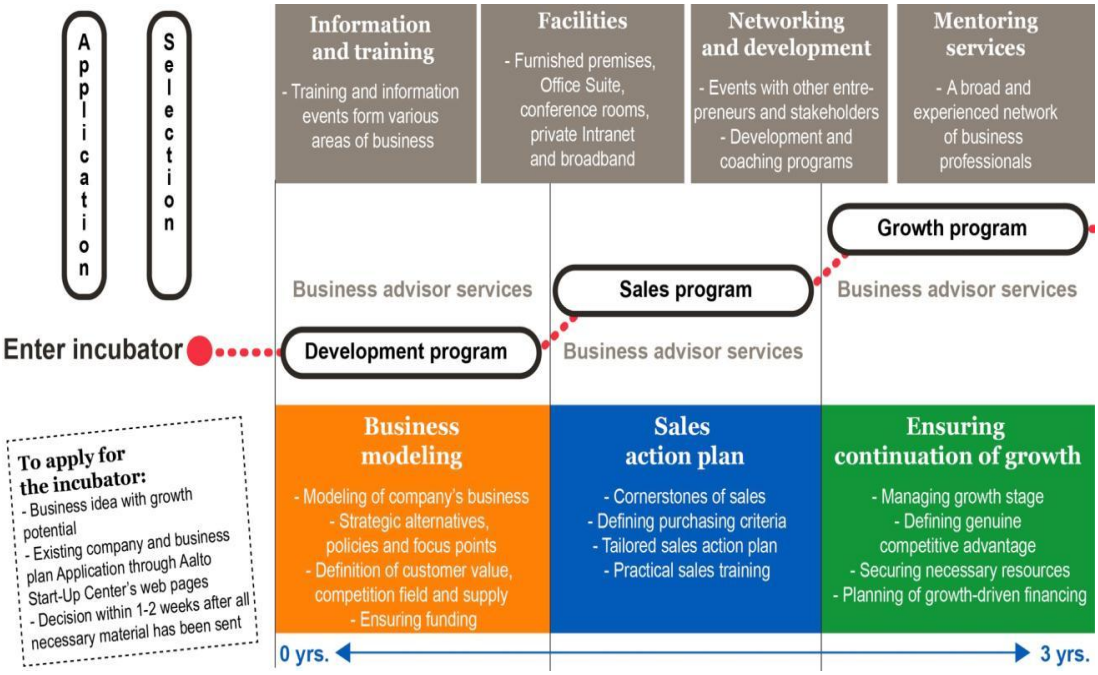
4. Finnish experience of technology transfer from universities to industry

Considering its level of success, Finland can be a role model for many developing countries in how research generated at universities can be transferred to industry successfully. There are three types of players in technology transfer system in Finland – universities, public research centers and private companies. Universities in Finland like Aaalto University play a significant role in stimulating innovation in Finland. Aaalto University was created in 2010 when three universities – Helsinki University of Technology, Helsinki University of Economics and the University of Art and Design Helsinki merged. The main purpose of the merger was to create a university that fosters research and innovation. In this direction, Aalto University has launched projects like Aalto Design Factory, AppCampus, ADD LAB and Aalto Ventures Program. Aalto Entrepreneurship Society is the largest student run entrepreneurship community in Europe. It organizes Startup Sauna accelerator program for startups and has raised more than $36 million in funding since 2010. Other universities such as University of Oulu and University of Turku are also active in transferring technology generated at the university to industry.

Aalto University established a startup center in 1997. Aalto Star-Up Center is part of Aalto University research and innovation team. 800 startups companies have graduated from Aalto University Start-Up Center. Currently, Aalto University Start-Up Center has about 50 growth companies in its portfolio. Startups may apply to Aalto University Start-Up Center through website and submit their business plan. Startups with high growth potential may be admitted to Aalto University Start-Up Center for up to 3 years. During the 3 years they go through three programs: development program, sales program and growth program. During the development program, startups go through business modelling, where startups develop the company's business model, strategic alternatives, identify their customer value, competition and their supply chain and get seed funding. In the sales program, startups define purchasing criteria of customers and receive practical sales training. At this stage startups also develop sales action plan intended for their target market. In the final stage (growth program), firms plan growth-driven financing and secure necessary resources for the startup's growth (exhibit 4.1). Nearly 200 of the companies that have graduated from Aalto University Start-Up Center is active today. The annual turnover of the alumni companies is around 400 million euros. Among the most successful alumni of Aalto University Start-Up Center is Rovio, a

company that develops and distributes video games. Annual revenue of Rovio was 142 million euros in 2015 and employs 435 employees (www.rovio.com).

Exhibit 4.1: Aalto University Start-Up Center startup growth process



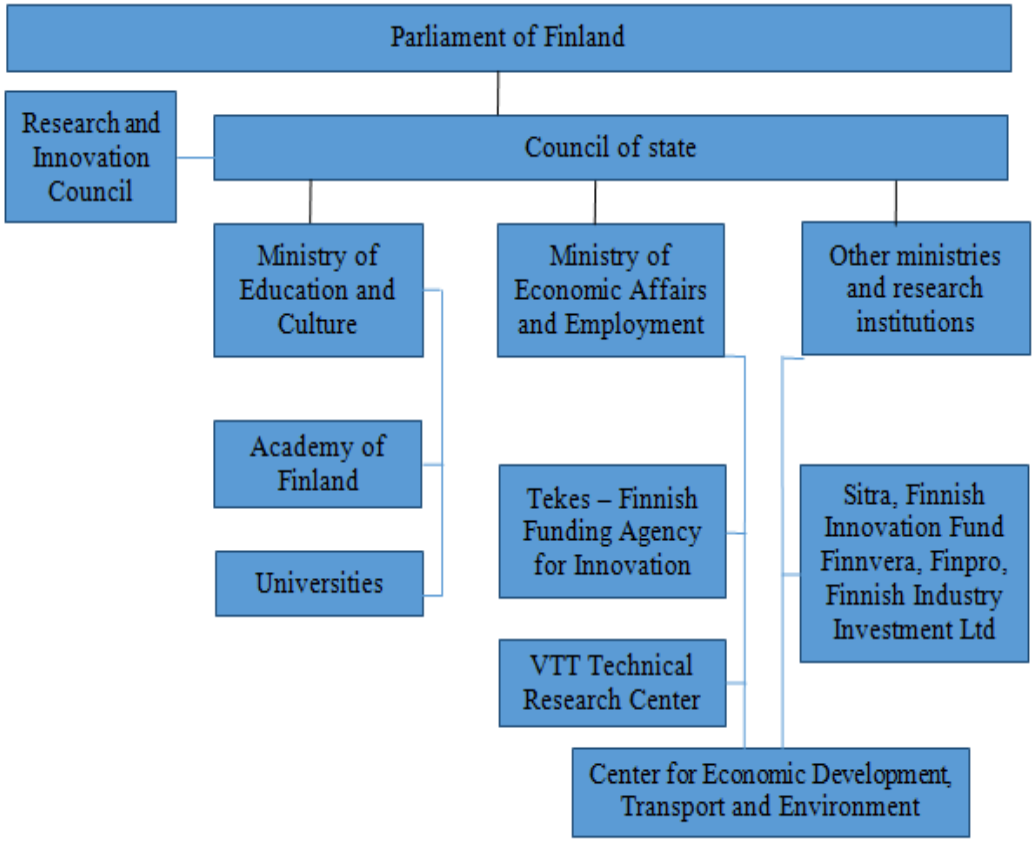
Source: Aalto Start-Up Center documents

Finland also has unusual education system where they teach entrepreneurship to business students entirely based on practice called Tiimiakatemia. Tiimiakatemia means "Team Academy" and originated from the University of Applied Sciences in Jyvaskyla, Finland. 37% of students who graduate from Tiimiakatemia have their own businesses within 6 months after graduation. 47% of the students who graduate from Tiimiakatemia become entrepreneurs 2 years after graduating. Student teams establish their businesses while they are studying in Tiimiakatemia. Annual turnover of students of Tiimiakatemia is more than 2 million euros (www.tiimiakatemia.fi).

The second important player in the process of technology transfer is VTT Technical Research Center. VTT Technical Research Center is a leading R&D organization in Nordic countries and provides expert services for domestic and international partners both in private and public sectors. It produces research and innovation services that increase the international competitiveness of companies and society. VTT falls under Ministry of Economic Affairs and Employment (Exhibit 4.2). VTT Technical Research Center VTT is responsible for applied research and therefore fills the gap between basic research, which is conducted at universities and

development, which is done in the industry sector. More than VTT 2400 researchers who come from 41 different countries are responsible for carrying out the applied research.

Exhibit 4.2: Public Decision Makers, financiers and R&D performers



Source: VTT Research Center Documents

In 2014, VTT was the second most active patenting organization in Finland and about 36% of Finnish companies have benefited from expertise of VTT and innovations carried out at VTT. VTT R&D infrastructure includes the following:

- Biotechnology and food research piloting environment, which offers unique facilities for the development and customization of bio and food industry technologies;
- Engine and vehicle labaratory, which enables research on passenger cars as well as heavy duty vehciles up to 60 tons to develop energy efficiency, emissions reduction and use of 2nd generation biofuels;
- Center for nuclear safety designed for nuclear technology safety research;

- VTT Metrology, which is the National Metrology Institute of Finland and performs high level metrological research and develops measuring applications in partneship with industry;
- PrintoCent, which is the world's first pilot factory for printed intellifence industrialization;
- A pilot-scale research environment for fibre processes which enables the development of novel products and supports the renewal of pulp and paper industry;
- Micronova, which is a world class facility fully equipped for the fabrication of silicon, glass and thin film based microsystems.

VTT Technical Research Center has research units in different parts of Finland as well in South Korea and Brazil. VTT has over 1200 patents and patent application. In 2015, VTT made 296 inventions and 48 new patent applications. VTT researchers also published 614 scientific articles in 2015. In 2015, VTT has generated 21 spinoff companies which were created as a result of the research conducted at VTT. VTT Ventures Ltd is a development company that generates and develops spinoffs based on VTT's technology. The company works closely with VTT scientists to find the most valuable new technologies to commercialize. Through VTT Ventures, entrepreneurs have access to innovative ideas and know-how of nearly 380 patent families. This is the bases for the dealflow that enables VTT to create companies with global potential. As of 2016, there are 21 companies in the portfolio of VTT Ventures generating 35 million euros of annual revenue (VTT Review (2015)).

Third important part of Finland's technology transfer system is the private sector participants. Among different private sector participants, Technopolis has an important role in stimulating innovation in Finland. It is an international chain of technology parks. Technopolis was first established in Oulu in 1982. Because of high demand for its services from companies like Nokia, Technopolis grew 2300% until 1999. In 1999 it was listed as a for profit public company in Helsinki stock exchange. Technopolis operates in 6 countries and 13 cities. In Finland, Technopolis has branches in cities of Helsinki, Espoo, Vantaa, Oulu, Tampere, Jyvaskyla, Kuopio and Lappeenranta. Besides Finland, Technopolist has branches in Oslo (Norway), Tallin (Estonia), St. Petersburg (Russia), Vilnius (Lithuania) and Gothenburg (Sweden). Technopolis has 21 campuses with more than 120 buildings. It has about 1,700 resident companies located in Technopolis with total employees of 49,000 people.

Technopolis offers not only space but also supporting services to its resident companies. Through such support, Technopolis enables its reseident to focus on their growth and make their operations more efficient. Technopolis facilitates local

and international networks for its resident companies.Technopolis offers value to its customers in different stages of lifecycle (table 4.1).

Table 4.1: Value offered by Technopolis to its residents

Startups	Growing companies	Mature companies	Public sector	International companies
Flexible and affordable premises; Services which make it easy to start operations; Impressive premises which help in finding the first recruits and customers; Contacts from Technopolis events	A growth path for the future; Services enable focusing on core business; Representative premises and services for the employees help to find and keep the employees	Efficient services bring ease and profitability to the business; More and better contacts and business from Technopolis customers and events	Business contacts to private sector; Flexibility and speed for the workplace operations; Quality premises that function well All services can be budgeted with ease	Premises and services with one single contract make it easy and fast to start business; International reach – 6 countries and 12 cities; Flexible contracts make it easy to grow

Source: Technoplois Documents

1. Conclusions and recommendations

The government of Azerbaijan views transition from an economy based on natural resources to an economy based on innovative entrepreneurship as one of the high priority tasks. Developing innovative entrepreneurship is listed as one of the priority goals in state program "Azerbaijan 2020: Vision into the Future". This study has analyzed experience of Finland, which is one of the global leaders in the field of innovative entrepreneurship and technology transfer with the purpose of developig proposals for policy makers. Despite the arguments against using the experience of developed countries in formulating strategies for emerging economies, there is strong evidence supporting the notion that emerging economies should adopt the models and follow the recipes of developed countries.

As Azerbaijan moves forward in developing technology transfer, the experience of Finland offers valuable lessons. As mentioned in section 2 of the paper, one of the main reasons behind the success of Finland is the presence of a catalyst organizations

which bridge universities and industry. Public research institutions like VTT Technical Research Center work shoulder-to-should with representatives of the private sector in carrying out applied research, which have significantly high probability of being commercialized. Most of the fundamental research carried out by universities and research insitutions remain uncommercialized due to their nature. Considering this inhibiting factor, it is important to encourage and support universities and research institutions in Azerbaijan to focus on applied research. In the long-term, establishment of catalyst institutions similar to VTT Technical Research Center woudl accelerate the process of technology transfer in Azerbaijan.

This study was one of the first to analyze the start-up ecosystem in Azerbaijan, which is important in stimulating innovation. The results of the in-depth-interviews with managers of start-up incubators and accelerators in Baku indicate a positive trend in the involvement of three important sectors – government, private sector and academic sector in establishing and developing the ecosystem. High-Tech Park established by the Ministry of Communication and Information Technologies, QUTechnopark established by Qafqaz University, Barama and AppLab accelerators of mobile operators Azercell and Bakcell as well as privately owned accelerators such as Sup.az, Next Step and Baku Business Factory show an interested by all three sectors in building a competitive innovation ecosystem in Azerbaijan. However, through the Delphi techniqe, it was determined that there are some challenges the ecosystem is facing, such as the gap in financing new technology based start-ups, shortage of talent pool and need for more effective legal infrastructure. These challenges require more involvement by universities, private sector and the government. Universities training specialists in the field of entrepreneurship and engineering should focus more on applied learning. Entrepreneurship education similar to Tiimiakatemia can be adopted by Azerbaijani universities offering degrees in Business Administration and Entrepreneurship. With regard to financial and legal infrastructure, there is a need for adoption of legislation regulating relationship between investors and founders of new technology based firms. The experience of Finland demonstrates that there is a need for more active involvement of government funding similar to Tekes in funding new-technology based firms. The State Fund for Development of Information Technologies (ICT Fund) was established in 2012 under the Ministry of Communications and High Technologies of the Republic of Azerbaijan. The objective of the ICT Fund is to stimulate innovative activities and provide finanial support (www.ictfund.gov.az). In order to expand the activities of the ICT Fund, there is a need for closer cooperation between the Fund and start-up accelerators.

Moreover, there is a need for a more specific partnership between the ICT Fund and universities in the area of commercializing research conducted at universities. There is also a need for start-up incubators and accelerators in Azerbaijan to develop closer ties with universities. Aalto Start-Up Center of Finland was established and operates as part of Aalto University and benefits from the expertise of professors and researchers as well as organizational support of the university. A closer collaboration between universities and accelerators (and private sector at large) woud help the universities to better plan their research activities. Such partnership would also accelerate the commercialization of the research conducted at universities.

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