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THE WAYS OF IMPROVING THE INNOVATION POLICY IN AZERBAIJAN

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ABSTRACT

Innovation policy of the government contains the support for the process on transformation of ideas or inventions into the value-added product or service for customers. Main components here include: (i) support for (financial and technical) innovative ideas and establishment of relevant education system; (ii) elimination of obstacles to innovation process via competitive environment and legal reforms; and (iii) Research and development activity (R&D) financed and/or implemented directly by the government. The subject of this research is the 'ways of increasing the efficiency in the innovation policy in Azerbaijan'. The research is mainly based on these questions: (i) how the innovative activity should be encouraged and what kind of objectives and tools the government should have for innovation policy? (ii) What are the risks and opportunities for the effective innovation policy in natural resource dependent country, like Azerbaijan? (iii) What kind of activities should be implemented regarding the science, education and finance components of the strong innovation policy model?

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1. MAIN CONCEPTS: INNOVATION, NATIONAL INNOVATION SYSTEM AND INNOVATION POLICY

Innovation refers to the creation of new or significantly improved product, process, marketing solution and organizational management that add value to society, government and market dominated by private sector and their development. Below the *Scheme 1* describes the innovation samples on each of 4 categories.

Scheme 1. 4 directions of innovation concept and examples

	New product (*for example, smartphone*)		Marketing innovation (*for example, new packaging*)
	New process (*sale of bar-coded goods*)		Innovation in organizational magamenet (*for example, training for employees*)

Source: "Innovation Union: a pocket guide on a Europe 2020 initiative". European Union, 2013 (p.4)

It can be argue that innovation has direct connection with the economic growth and material well-being[1]. There are number of factors determining the innovation capacity of the country, while individual talents, initiative and state supports are not suffice for this task. It is an issue, which requires ecosystem. While researching the USA, one of the leading countries among the innovation field, one can note that, the factors which create ideal terms for the innovation include *state policies, business environment, academic sector, quality of initiative, scope of the financial funds, tolerance level to diversity, national market depth* and all other components. That is the very reason why the

[1]Hulya Ulku. "R&D, Innovation, and Economic Growth: An Empirical Analysis". IMF Working Paper. WP/04/185. 2004 (səh.3) (https://www.imf.org/external/pubs/ft/wp/2004/wp04185.pdf)

companies like Google, Apple, and Boeing are established not anywhere, but in America.

Timing is of great importance in innovation and premature involvement into the work can result with loss for the investors with no chance for the commercialization. Whereas, late engagements contain high barriers to enter the market and increase the investment costs. *In a market with established trends, it is a challenge for a new player to gain the competitor position in innovative sectors*. With focus on the establishment of added value, Azerbaijan is obliged to define its mid and long term innovation strategies. However, it should be reminded that, without innovations in this challenging competition world, the survival of the economies is difficult. On the other side, one can notice the increase of the countries' shares in GDP in terms of the research and development, or innovation costs, where it serves one objective: *the countries' intention to maintain their competitiveness via innovations and their efforts towards strengthening this capacity*.

National Innovation System (*NIS, Scheme 2*) as a component of innovation strategy, is a collection of relationships and elements which have mutual connection in the use, introduction and dissemination of useful and new economic knowledge within the boundaries of the country. The NIS ensures the efficiency of achievement, development, dissemination and use of the knowledge in the country. Sub-domains, which have to be regulated in coordination by innovation policy, include *education, scientific research, trade, finance and industry*. Innovation is directly related with the notions like high technology (*high tech*), research and development. However, from a broader perspective innovation encompasses the introduction of any new product, service and production process. It also includes significant improvement in the technical specifications, component and materials, software, user friendliness, and other functional features of the good and/or services.

Scheme 2. Innovation systems in the developing countries

1. Obtaining new innovation / know-ledge from external source

2. Obtaining new innovation/know ledge from internal source

3. Development of new innovation/ knowledge in the country:
State Research Institute;
Universities and training institutes;
Companies;

Acquisition and transfer of knowledge:
- purchase of components and technological licences of capital products
- copying engineering and change thereof
- external technical assistance service
- training and education abroad
- companies' investments
- involvement of people with technological and research skills
- information technologies and knowledge-sharing networks

Users of knowledge/inno-vation:
- Industry, service, agricultural companies;
- Planning and implementation activity of governmental agencies;
- State education and health agencies;
- Social organizations and individuals;

Transfer of locally developed knowledge:
- patents and licences
- technological consultation service
- education and training
- Business incubator and tech-based firms
- research institutes and universities
- business and social sectors

4. Dissemination of knowledge:
- Growth of effective firms
- qualified suppliers
- engineering and consultancy firms
- human and ICT networks
- information and productivity centers
- technological infrastructure
- standards, metrology and quality control

Main conditions: economic and instituional regime, information-communication infrastructure and education

If to take innovation as a process, then the innovative processes, which improve the productivity and enable the development of new product, will prevail (*for example, automation of manual work, new quality control tools, introduction of new software for the management of product residues*). Purchase of new vehicle for manufacture of new product can be referred as both product, and process innovation. Process innovation is more effective and low-costed manufacturing and sale of existing product. Innovations do not always cover new technologies. Organizational innovations may come out as a new approach to business practices, organization and foreign relations. Organizational innovation envisages to reduce administration and operational costs, and improve the performance of the company via achievement of non-traded assets and reduction of logistic costs (*for example, decentralization of decision-making system and digitization of supply chain management*). Marketing innovation can be oriented on the reflection of the customers' needs, expansion into new markets and re-marketing of the firm's product. However, the innovation should not mean any change or novelty in the companies, but it should be determined by its real efficiency. In the high and medium tech production sectors (*such as pharmacy and electronics*) – in particular in knowledge-intensive service sectors (*such as telecommunication and/or information technologies*) - firms are capable to present more new products in comparison with the low-tech firms (*such as wood processing and/or textile*). Unlike product innovations, process innovations are more usual for the low-tech industry sectors and here the firms are in the search of more efficient production methods.

Innovation policy is the collection of the approaches and actions of the government which affect the innovation process (enhancement and introduction of the *product and process innovations*). Main objective of this policy is not limited only with economy (*economic growth, productivity growth, employment and competitiveness*), but also can include cultural, social, environmental and military targets. The

government, by its innovation policy, should motivate the solution of the problems in the aspects like research infrastructure of innovation process and activities, investment, market access and commercialization, regulatory framework and technology transfer[2]. The worldwide government innovation policy includes the following directions: *development of national innovation system and optimizing the structure thereof; optimizing the state financing in the field of science and innovation; developing the basic researches, strengthening innovation cooperation between domestic business and science; attracting extensive state capital and private equity to the field of science and innovation; stimulation of the innovation activity of private sector through the involvement of the foreign capital; motivating the innovation initiatives of scientific sector; integrating with international innovation network; technological qualification; developing the internal innovation network; stimulating innovative initiatives of regions; integration of science and education; attracting small and medium business to the innovation field; and making priorities in high tech field.*

The research shows that, as a measure of innovation policy, the supports which are oriented to the research and development costs are effective, but for more sustainable innovation system, support to the innovation activities of the firms with less than 50 employees and limited innovation capacity should be priority[3]. In this case, the innovation policy along with the the increase of "R&D" costs, and provision of trained human resources should target the continuous innovation acticity not only in large companies, but in 'start-ups' as well[4]. Sustainability should also be applied to innovation infrastruc-

[2]Cristina Chaminade, Charles Edquist. "From Theory to Practice: The Use of the Systems of Innovation Approach in Innovation Policy". CIRCLE Electronic Working Paper Series. Paper no. 2005/02 (p.142-143)

[3]Martin Andersson, Börje Johansson, Charlie Karlsson, Hans Lööf. "Innovation and Growth: From R&D Strategies of Innovating Firms to Economy-Wide Technological Change". Oxford University Press 2012 (p.203)

[4]Patrick Llerena, Mireille Matt (Eds). "Innovation Policy in a Knowledge-Based Economy: Theory and Practice". Springer-Verlag Berlin Heidelberg 2005 (p.47-48).

ture, where one of the main organizational forms is technoparks. 3 main operating mechanisms of technoparks (*university technoparks, regional area technopark, industry technoparks, technology incubators and innovation business incubators; network technoparks etc.*) are following: *(1) support for independent research and project teams who want to implement their own innovation projects; (2) support for the commercialization of scientific knowledge collected in university and scientific-research teams; (3) solving the technological issues of the producers through concluding technological decisions from the independent market of innovation*. The followings can be considered as the state support measures: development of unified state register of innovation infrastructure subjects; definition of minimum level of scientific and innovation allocations in the budget; development of state and private insurance of innovation risks; allocation of free-of-charge production field for innovative small enterprises; and provision of legal and financial consultancy to these small enterprises[5]. As we know, the innovations are based on 5 main factors: ***investments, institutions, human capital, existing infrastructure and business environment***. Major factor in the initial phases of the innovation process during the establishment of the knowledge-intensive firms and 'start-ups' is the existence of the venture capital market[6]. Even due to its higher risks and its impact to the business cycle, the innovation can take out the economy from tranquillity (theory of '*creative destruction*' of Schumpeter). Due to the imperfect design of the innovations, their first use is accompanied with certain risks and challenges. Therefore,

[5]The Institute for Scientific Research on Economic Reforms (ISRER) under the Ministry of Economy of the Republic of Azerbaijan. Final report on the scientific-research work on the subject "Development of proposals and suggestions on the establishment of Technopark and Agroparks in Azerbaijan for technological innovations on the basis of internatinal experience', 2014 (pages 21 and 91) http://ier.az/uploads/IIETI%20(YekunHesabat2014)%20(2)%20aze.pdf

[6]Togrul Mashalli. "We have a gas meter, they have computer and military technologies". Open governmental portal. 07.04.2017. http://opengovernment.az/blog

it is very important to focus the support on the Azebraijani investors with higher risks, rather than the foreign investors'[7].

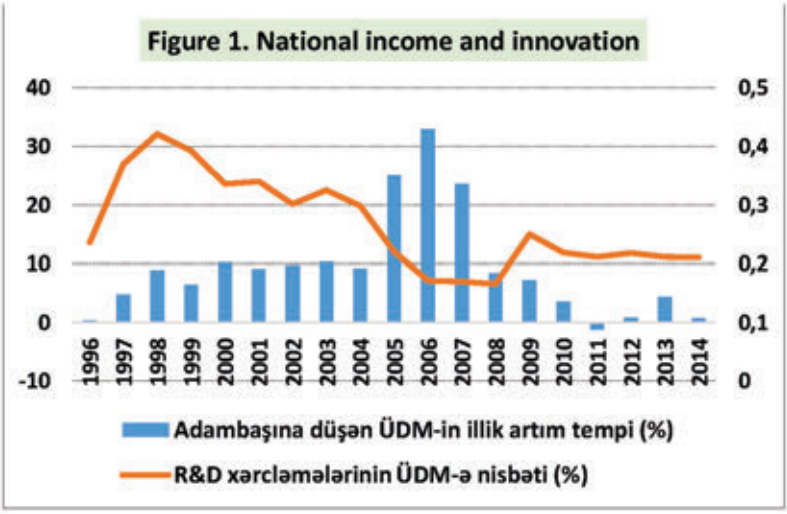
2. INNOVATION EXPENDITURES AND DYNAMIC CYCLE OF NATIONAL INCOME IN RESOURCE-RICH COUNTRIES: CASE OF AZERBAIJAN

The goal of economic policy is to accelerate the provision of welfare. Economic welfare requires economic growth and economic growth requires technological changes or innovations. Therefore, all economic growth theories consider the adaptation to current technologies or use of new technologies to be important in continuous economic growth as a factor stimulating productivity. Here technological change and innovation process are viewed in wide spectrum. Innovation does not occur only in a limited number of high-tech industries. This is actually a phenomena occurring in all sectors. Even the enterprises operating in *low-tech* or traditional industrial sectors gain grand sales from the technologically new products and processes. Service sector which is a major sector of the developed countries is also innovative enough. *"Linear model" of innovation* of neoclassic economic growth theory covers primary conditions of technological changes in the industry. Here the fundamental researches and applied developments, project engineering for product, knowledge commercialization and marketing stages are reviewed[8].

Following the decline in oil revenues, the economy of Azerbaijan really needs the innovations in all fields[9]. The empirical researches show that the oil-gas rich countries lag behind the countries not rich with re-

[7]Vusal Gasimli. "Economic Modernization". Center for Strategic Studies. Baku. 2014 (pages 83-84, 91)
[8]Lynn K. Mytelka, Keith Smith. "Innovation theory and innovation policy: bridging the gap". UNU/INTECH, DRUID Conference, Aalborg, June 12-15 2001
[9]IMF. Republic of Azerbaijan: 2016 Article IV Consultation-Press Release; Staff Report; and Informational Annex September 14, 2016. http://www.imf.org/external/pubs/cat/longres.aspx?sk=44269.0

cources, and have more needs for the technoligical innovations in terms of constant economic growth (*during 1960-2006, average economic growth was 1,67% in oil-rich countries, while this indicator was 1,76% for non-oil countries*)[10]. In this respect, main objective of the economic development strategy of Azerbaijan is the achivement of constant economic growth and diversification of the economy. To that end, official state policy includes the *establishment and* development *of sound motivation tools for the enhancement of the introduction of innovations* in the economy. Because the introduction of the innovations can have positive impact on the economic growth and this is one of the factors of economic growth. A high positive correlation has been verified between the economic growth and technological development (measured by innovation expenditures and patent statistics)[11].



Source: World Bank Metadata System (http://data.worldbank.org/)

[10]Michael L. Ross. "The Oil Curse: How Petroleum Wealth Shapes the Development of Nation". Princeton University Press. September 8, 2013 (p.190)
[11]Peter Nijkamp, Iulia Siedschlag (Ed.-s). "Innovation, Growth and Competitiveness: Dynamic Regions in the Knowledge-Based World Economy". Springer-Verlag Berlin Heidelberg 2011 (p.18)

There is not a clear correlation during 1996-2014 for which it's possible to make statistical comparative analysis between the innovation (R&D) expenditures ratio to GDP and annual GDP growth rate per capita in Azerbaijan (-0.21). But the interesting point is that if correlating between two indicators of national income per capita for 2002-2007 when it showed special growth dynamic, we'll see very high negative correlation (-0.93). ***During the period of financial welfare in the country the innovation expenditures did not increase in relevant rates, in the contrary, its share in GDP decreased even more (Figure 1).*** Within 2008-2014 a clear correlation is not observed due to high volatility of both indicators. Empiric researches indicate that in case the traditional manufacture factors provide 65% of economic growth, then innovative novelties in technology provide 35% of economic growth. If GDP share of innovation (R&D) expenditures increases additionally 1%, the economic growth rate would additionally increase more than 0.25% in the developed and developing countries. *Bringing the GDP share of innovation (R&D) expenditures up to 1.5%, effective university-industry relationships, public-private partnership promotions in innovation actions might be key goals of the government's innovation policy*[12]*. But in order to achieve all these goals, a short, middle and long term action plan shall be developed through continuous exchange of views of public and private sector representatives, academic representatives (such action matrix is given in the ending of this document).* In Norway, which is the oil-gas rich country like Azerbaijan, the objectives of innovation policy include: *(1) eliminate the market failures which come out as different private and social benefits of innovation investments; (2) subsidize the research and development activities of large companies under state*

[12]Cuma BOZKURT. "R&D Expenditures and Economic Growth Relationship in Turkey". International Journal of Economics and Financial Issues. Vol. 5, No. 1, 2015, (p.188-198)

ownership (national champions); and (3) develop the technological improvement capacity of entities in industry[13].

3. LEADING INNOVATION INDICATORS IN AZERBAIJAN

New innovations can be either the imporvement of existing goods, or it can be a new product, process or business model based on completely new knowledge. The innovation can entirely result from the demands of market or it can be market oriented. At the same time, however, the innovation can be the product of the 'R&D' laboratory of the company[14]. For this purpose, 'R&D' spendings are required from governmental and non-governmental sources. Internal "R&D" spendings are implemented by the residential companies, scientific-research institutes, and university and state laboratories in the country. 'R&D' spendings also include foreing funds, but it is not also exception that, the government can put some funds aside for 'R&D'. This indicator is estimated as million US dollar and interest ratio in the GDP[15]. Furthermore, for any country, including Azerbaijan, in terms of the export, the share of the knowledge-based technological products has got a significant role within the main innovation indicators. In 1994, due to partial functionality of the production facilities established during the Soviet Union, the share (*from electrical engineering to optical devices*) of the knowledge-based products in the export of Azerbaijan was up to 15%. In 2015 this indicator constituted 0,7 % of overall export.

[13]Jan Fagerberg, David C. Mowery, Bart Verspagen, "Innovation, Path Dependency and Policy: The Norwegian Case". Oxford University Press 2009 (p.352)
[14]PWC Innovation Strategy. https://surveys.strategyand.pwc.com/InnovationStrategyProfiler/index.php (15.12.2016)
[15]"Gross domestic spending on R&D". https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm (15.12.2016)

Table 1. 8 indicators of innovation economics

Category	*Indicator*	*Indicator of Azerbaijan (2015)*
Output	Spending for basic and applied research (R&D)	123.23 million AZN
Output	Number of the employees working in the sector of basic and applied research (R&D)	23.093 people
Output	Number of patent applications by residents	168
Input	Inward and outward direct investment stock (comparatively to the GDP)	7.63% / 6.05%
Input	Number of students graduating from higher education institutions	29333
Input	Number of population engaged in knowledge-intensive economic activities	59.600
Input	License and patent revenues from abroad	-----
Input	Share of high-tech exports	0.7%

Source: http://www.stat.gov.az; http://data.worldbank.org/

Azerbaijan was ranked as 85 out of 128 countries in 2016 in Global Innovation Index. The position of the country was ranked 101 among 128 countries on the sub-category '*Scentific and technical articles'* of this index. Here the indicators which were assessed included the number of patents, scientific articles and new innovatives businesses[16]. In the sub-index on *Global Competitiveness Index 2016-2017,* our country was ranked 44 out of 138 countries. However, the ranking of the country on patent applications sub-category was

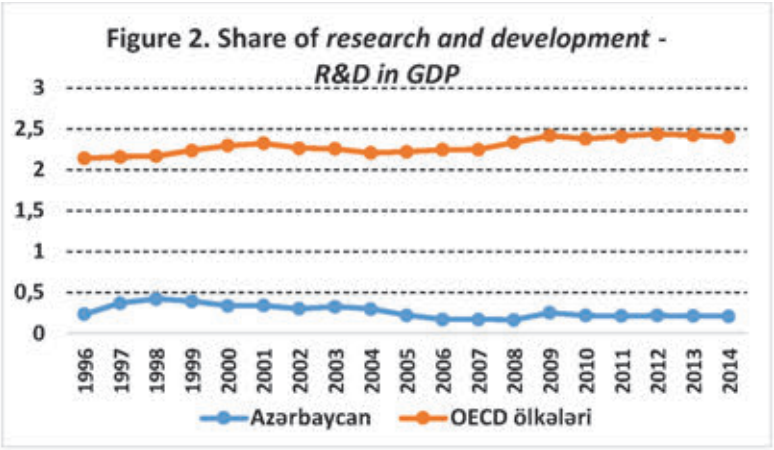
[16]Global Innovation Index 2016. https://www.globalinnovationindex.org/gii-2016-report# (10.12.2016)

80 out of 138 countries[17].

Weight of the equipment, machinery and devices in the value of the main funds used for scientific research and developments in Azerbaijan is lower (27%) in comparision with most of the CIS countries. Organizations performing research and development activities in Azerbai- jan include scientific-research institutions (91), design organizations (3), higher education institutions (39) and other institutes (8). The number of organizations dealing with R&D was 141 in 2015, while the number of the employees engaged in R&D activities was *23,093*. Nearly half of the researches (47%) in Azerbaijan are over 50 age, ***while 25% are over 60***. By the end of 2015, the sectoral breakdown of the R&D organizations is as follows: 64.1% state, 28.3% higher education sector (***in total 92.4% are state organizations)*** and 7.6% private sector. Gender breakdown of R&D staff was 12,310 women and 10,783 men in 2015. By the end of 2015, 70% of R&D staff was researchers, 19% was technicians and supporting team and 11% is other staff. General costs spent for R&D in 2015 constituted ***132,2 millon AZN*** (98% domestic costs), which was equal to ***0,36% of non-oil GDP*** for that very year. The amount of the scientific-technical works implemented in 2015 was 116,6 million AZN, great part of which was composed of ***basic researches (47%)***. Lesser part was composed of applied researches, project-design and activities on transfer of technology. The amount of the main funds used for R&D was 114 million AZN in total in 2015. Internal costs spent for the R&D was composed **mainly from budget funds** (71%), as well as extra-budgetary funds, private funds and the funds of the clients (25%). Majority of these internal current costs spent for R&D is in the field of technical sciences[18]. In Azer-

[17]The Global Competitiveness Report 2016–2017
http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf

baijan the share of the processing industry within general investmens decreased from 11% to 5.7% during 2013-2015. As to investments in the production of computer and electronics during 2005-2015, here the investments included only 8.72 mln AZN (*even in 2014-2015, this price was 100 thousand AZN*).



Source:
http://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?view=chart

Currently the weight of the R&D spendings of Azerbaijan in GDP (0,2%) are lower than the average figure for the worldwide (*Figure* 2). The comparative graphics below shows that, the share of the 'R&D' spendings in the GDP (0,2%) lags 12 times behind the average indicator (***benchmark: 2,4%***) of the OECD countries composed of the developed and developing countries of the world. In 2015, the industrial enterprises spent 35,2 million AZN for technological innovations, 74% of which was the costs spent for introduction and development of new products, services and new processes,

[18]State Statistics Committee. "Education, science and culture in Azerbaijan". Statistical yearbook. 2016 (page 305).

and purchase of machinery and equipment related with technological innovations. ***Nearly 0,03%*** of technological innovation costs of the industrial enterprises in 2015 was the scientific R&D spendings[19]. After 2011-2012, Azerbaijan industry experienced serious decline in the production of significantly improved product or newly applied product, as well as improved product innovations (*decline from 24 million AZN in 2012 to 1,5 million AZN in 2015*). In the annual report of SSC, the list of '*Factors impeding the innovations in industrial enterprises*' includes lack of funds; non-sufficient funds from the state support; higher economic risk; low innovation capacity of the enterprise; lack of information on high-tech; and higher costs of innovations[20].

4. LEGAL FRAMEWORK OF INNOVATION POLICY IN AZERBAIJAN

A number of state programs and legal and regulatory documents of Azerbaijan contain several provisions on innovations. First of all, ***the Law of the Republic of Azerbaijan 'on Science'*** (***14.06.2016***) defines main principles of the state policy in the field of organization, management and development of scientific activities, objectives of the science and scientific-innovation activity; funding mechanisms for the science and stimulation of scientific achievements[21]. According to the Article 4 of this Law, titled 'Main direction of state policy in the field of scientific innovation', the state provides equal grounds for all enterprises and organizations engaged in scientific innovation activities and stimulate their functionality. This article prescribes that, state policy in the field of scientific innovation is implemented in the following directions: *(1) identification of the*

[19]State Statistics Committee. "Azerbaijan industry" Statistical yearbook 2016 (page 96). http://www.stat.gov.az/source/industry/
[20]State Statistics Committee, "Factors impeding the innovations in industry enterprices", 2016. http://www.stat.gov.az/source/industry/

strategic directions for the development and improvement of the state innovation policy; (2) creation of favourable terms for financing innovation projects, attracting and promoting investments; (3) establishment of scientific innovation subjects –integrative science, education and entrpeneurship centers, technopolicies , scientific and technology parks, technological incubators, innovation funds, and information databases on innovations; (4) establishment of high-tech based production areas, supply of market and entry to foreing markets; (5) study of innovative development practice and its use in the preparation of development strategy.

Innovation policy and establishment of innovation economy are one of the priority issues in the strategic state documents of Azerbaijan. In the strategic documents approved by the Presidential Decree of the Republic of Azerbaijan, date of December 06, 2016, 'On the approval of the strategic road maps on national economy and main sectors of the economy of the Republic of Azerbaijan', although fragmented, but large part is devoted to the innovations. The action 3.1.4 of '***the Strategic Road Map for the national economic perspectives of the Republic of Azerbaijan'*** which was approved by the Decree and signed to define the sustainable targets of non-oil sector and perspective development targets of the country,[22] is named as the 'Promoting the 'education-research-innovation' way of development in higher education institutions' and states that the establishment of university clusters can improve the efficiency of '*education-research-innovation*' chain: "*The establishment of university clusters will stimulate the implementation of researches and improvements and the application of the scientific results to the production, and hence the efficiency of the 'education-science-production' relations will be improved'*".

[21]The Law of the Republic of Azerbaijan 'on Science' (14.06.2016). http://science.gov.az/uploads/PDF/Elm_haqqinda_Azerbaycan_Respublikasinin_Qanunu.pdf (10.02.2017)

[22]"Strategic road maps for the national economy and main economic sectors have been approved". 06.12.2016. http://azertag.az/xeber/1016938 (10.02.2017)

Action 3.1.5, titled as 'Support for the building of knowledge-based society, founded on the development of scientific research activities', includes the list of the actions related with the development of science, improving the quality of the scientific researches, and promotion for the application of researches to the production in Azerbaijan: "*'Development of the science will be encouraged and stimulatory measures will be taken to provide the investment by private sector into the research and developments'*. According to the document, Azerbaijan National Academy of Sciences (ANAS), through active participation in 'science-education-production' chain, can make its contribution to the weight of Azerbaijan in the global production chain. Currently ANAS is taking a step towards the ***establishment of Research University*** with the objective of creating the chain of 'science-education-production'. Improvement of the business environment, by stimulating the companies to make investment in the research and development activities, can increase the weight of the private sector in financing the science. ***The action No 3.2.3 – 'Encourage to invest in the innovation activity'*** defines the innovation activity as a main leverage for increasing labour productivity and competitiveness in the fields of production and management: *'This activity will be taken into account upon the development of the action plans and state programs to stimulate the promotion of the innovation in Azerbaijan. To create incentives in the field of innovations, the country has got a number of opportunities to establish wide-range knowledge network through the award of prizes and loans to the scientific R&D for the production of high-tech products':* The action No 3.1.7 – Improve the physical and technological infrastructure playing role in the development of human capital' sets forth the following activities: (i) *The establishment of supporting bodies will be promoted, which will ensure the improvement of the material-technical base to the level of modern requirements in the science, education and production fields … and optimize the performance, test and application of scientific researches, and the'science-production-market' relations.* (ii) *Financial-credit infrastruc-*

ture (budgetary and non-budgetary fund, commercial bank) will be improved for the purpose of optimizing 'science-education-production' relations, developing qualified personnel and improving the financial capacity of scientific R&D. (iii) *Aimed at the establishment of the agile operating mechanism of the 'science-education-production' infrastructure, the activities on the foundation of regional and functional universities and production clusters will be encouraged. (iv) The development of the lifelong education system, university complexes, scientific-research institutions and production and service areas improving the economic efficiency will be supported.*

The document also envisages granting the *outcome based concessions and privileges* to the companies with the aim of stimulating their engagement in scientific-research activities and innovational development. For example, financial incentives for scientific-research loans. The Ministry of Education, together with the National Academy of Sciences and the Ministry of Economy should promote the 'education-research-innovation' form of development in higher education institutions in 2017-2018. The National Academy of Sciences, in its turn, together with the Ministry of Economy should take steps in 2017-2020 towards supporting the formation of the knowledge-based society which is driven by the development of scientific-research activities. However, in particular, the National Academy of Sciences should contribute to the dramatic improvement of a number of innovation indicators of Azerbaijan (*for instance, number of articles in scientific-technical magazines and patent applications*).

Overall management and supervision over the implementation of the strategic road maps will be done by the *Presidential Administration*, while the monitoring, evaluation and communication measures regarding the activities encompassed in the strategic road maps will be implemented by the *Center for the Analysis of Economic Reforms and Communication*. The Law on the Education defines the innovation as 'progressive novelties developed based on various institu-

Figure 3. Number of articles in scientific and technical journals

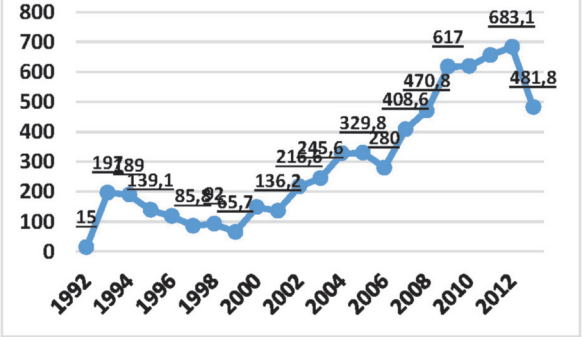
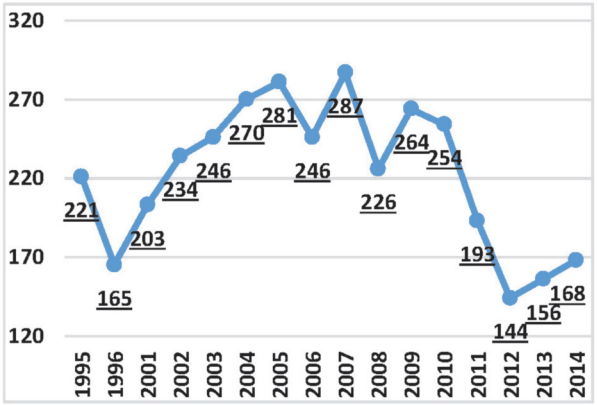


Figure 4. Number of applications for obtaining patents in Azerbaijan



Source: The World Bank metadata system (http://data.worldbank.org/country/azerbaijan?view=chart)

tions, scientific researches'[23]. Item 1.4 in '***State Strategy on the development of education in the Republic of Azerbaijan'*** (24.10.2013) puts forth '*the introduction of higher education standards which support the transformation of higher educational institutions into education-researc-innovation' centers and which provide the training of competive specialists*'as a strategic goal[24].

Approved by the Presidential Decree, date of April 2, 2014, the '***National Strategy for the development of Information society during 2014-2020***' (Item 8.1) sets forth that main objective of the high-tech industry is strengthening competitive and export-oriented high-tech industy, and establishment of innovation system which will ensure the development and application of knowledge-intensive and high-tech products. Furthermore, the objectives also include *(i) "measures supporting the imrpovement of innovation entrepreneurship, the development of knowledge-intensive and high-tech products and their entry into the international markets; (ii) improvement of the technoparks, business incubators and innovation structures fot the development and introduction of new knowledge and technology'*.

'***The Development Concept 'Azerbaijan 2020: look into the future***', approved by the Presidential Decree No 800, dated December 29, 2012, reflects similar objectives. The main goal set forth in the concept is the twofold growth of GDP through the development of non-oil sector in the next 8-10 years, and the achievement of this growth through the establishment of *innovation-oriented and knowledge-based economy* in the Republic. The Concept indicates that the importance of intellectual property, the main mission of which is to

[23]The Law of the Republic of Education (19.06.2009).
http://edu.gov.az/az/page/72/302
[24]"State Strategy for the development of education in the Republic of Azerbaijan" (24.10.2013).
http://www.e-qanun.az/framework/27274

stimulate creativity and innovation and support the regulation of the market, will also increase.

The concept stresses that main goal ahead is to ensure the innovation-based growth of economy. '*The development of industry on the basis of innovations will be possible as a result of the strengthening of scientific and technological potential and expansion of education opportunities. It is important to have economic growth based on productivity and production spheres with comparative advantage'*. The concept targets transition *to a stage characterized by the dominance of innovations. The use of innovative technologies* in industrial enterprises *will be stimulated and special and general industrial estates will be set up. Measures will be taken to encourage intellectual activity, create favourable conditions for investment in innovation and creativity,* ensure the sustainable development of a creative economy based on intellectual property and increase its share in the country's GDP. Section 4.3 of the concept 'Support for scientific potential and innovation activity' envisage the following measures:

- *"for speeding up the creation of science intensive technology and products, the expansion of innovative activity, improvement and modernization of scientific infrastructure;*
- *Stimulation of the involvement of other resources, along with state funding for the financing of science (to prevent "brain drain");*
- *Mechanisms for strengthening the link between science and production for innovation economy in the country and performing applied scientific studies for the requirements of the market.*
- *State support measures and legislation base in order to ensure the manufacture of competitive products by increasing innovation activity, and the development of mechanisms for the implementation of innovations; and efficient use of innovation capacity.*
- *The creation of a favourable environment for the development*

of new types of activities and products and the development of innovative entrepreneurship, and strengthening the measures towards the transfer and use of advanced technology.

- *Establishment of technoparks and innovation zones for the development and application of science-intensive products and technologies.*
- *Organization of the functionality of the State Fund for the Development of Information Technologies which is aimed at the development of innovative entrepreneurship and knowledge-based economy.*
- *Support for the development of innovation capacity reflected in the Long-term National Strategy and State Program on intellectual property*
- *Establishment of national innovation system which will ensure the use, assimilation and provide new knowledge and technologies".*

According to the document, in order to meet the demand for highly qualified experts and scientific staff, the favourable terms will be created in higher education institutions of the country for the close integration of education with scientific researches and innovations, relations with the advanced educational institutions of the world will be expanded, and ***effective measures will be taken to prevent 'brain drain' from the country***. Standards will be prepared and applied that will support institutions of higher education in nurturing specialists with knowledge and skills and in turning into centres of education, research and innovation.

As it is mentioned in the concept, when speaking about the close integration of education with scientific research and innovations, the main priority should be given to exact sciences and engineering. According to the ratio of the graduates from the *science and engineering (S&E)* professions against the overall university graduates, Iran is the second country in the world (46,6%), while Malaysia is the

sixth one (33,3%). Unfortunately, Azerbaijan was not ranked in the first places. The important thing here is about the quality of education provided by these universities of these countries, but these figures also important in terms of demonstrating the priorities of the youth in different countries. The demand for the graduates of exact sciences and engineering profession is created both by private and state sector. In other words, the government may act both as regulator and demand side through state universities and supply side through government institutions (state companies, government supported labs, special technology zones, PPP projects etc.).

Table 2. Graduates on exact sciences and engineering

Rank	*Country*	*Against the number of all the graduates*	*Rank*	*Country*	*Against the number of all the graduates*
2	Iran	46.6	49	Turkey	20.9
6	Malaysia	33.3	63	South Africa	19.0
17	Mexica	26.9	96	Brasilia	12.0
18	Saudi Arabia	26.9	97	Egypt	11.8
46	Indonesia	21.7	---	Chine	---

Source of statistic data: UNCTAD

In the '***State Program for the development of industry in the Republic of Azerbaijan for 2015-2020'***, approved by the Presidential Decree of the Republic of Azerbaijan date of December 26, 2014, it is stated that, innovations play a special role in increasing the competitiveness of the industry. In this regard, supporting the *research*

and development activities implemented by the private sector is of great importance. This process is accompanied with the improvement of the human capacity and scientific support of the industry. The documents states that, industry support measures, along with other measures, include the establishment of special economic zones, industry parks and industry clusters, special approach to specific sectors in the regions, support for the transfer of technology and promotion of the innovation. The policies on promotion of innovation in several countries can be classified into 4 groups in line with the development level and research capacity of the countries: *transfer of technology; improvement of in-house technological capacity; strengthening innovation orientation of small and medium sized enterprises; and improvement of the start-ups in terms of high and mid-tech.* In the document, it is also considered important "*to increase state support for expanding innovation activity; stimulate the application of the innovation oriented technologies in industry enterprises; and increase in the number of enterprises applying technological innovations'*. During 2016-2017, Ministry of Education should provide the establishment of innovation centres in higher education institutions through the involvement of private sector. In 2015-2017, Ministry of Economy, Ministry of Foreign Affairs, National Academy of Sciences, Ministry of Transport, Communication and Higher Technologies should expand international cooperation in the field of science, technology and innovation.

In different legal and regulatory acts, there are very fragmentary provisions on the promotion and regulation of innovation activity, and state principles in this field. Despite the inclusion of some regulatory provisions on science-innovation activity in the Law on Science, the establishment of state innovation system and its strategic directions are described in a very general way. Although the Law on Education does not include any regulatory provision on innovations, it still sets forth the definition of innovation in the beginning of the Law. To eliminate this light approach

on the innovation policy in the current legislation, either the Law on Science should be amended with new amendments on the principles and directions of innovation policy, or a separate draft law 'on Innovation activity and innovation policy of the government' should be prepared and enacted. Furthermore, unified definitions should be used in legislation acts and state programs related with innovation activity and innovation policy of the government. For instance, an important term Research and Development (R&D) is indicated as 'research and improvement' or 'research and development' in different state programs. State programs of Azerbaijan do not fully disclose the mid and long term objectives of innovation policy, the measures to-be-taken are not expressed specifically, but in general way, with no consideration of the economic situation of particular period, and key performance indicators (KPI) are not applied for the institutions in terms of years. Instead of general objective and actions based merely on the formation of innovative economy and high-tech, no realistic action plan based on different economic scenarios, against the existing situation, is presented. Without manufacturing mid-tech products, to set a target for the direct manufacture of high-tech products is a little bit challenging during the current financial and fiscal stability crisis period[25]*. It is not clear, which activities are particularly considered as stimulating measures for provision of investments in research and development. No assessment of financial and human resources for the implementation of particular innovation policy measures has been provided and expected outcomes are not separately analysed per each activity. Due to non-regular implementation of the monitoring and evaluation of existing state programs, the current status of the activities, to-be-implemented so far, is not clear.*

[25]Kanan Aslanli. "Fiscal sustainability and the State Oil Fund in Azerbaijan". Journal of Eurasian Studies. Volume 6, Issue 2, July 2015, pages 114-121. http://www.sciencedirect.com/science/article/pii/S1879366515000056

5. STATE INSTITUTIONS IMPLEMENTING INNOVATION POLICY, INSTITUTIONAL BASIS AND INNOVATION INFRASTRUCTURE

The report by the Institute for Scientific Research on Economic Reforms identifies that Azerbaijan does not introduce unified innovation policy and there is no single governing central state agency in this field[26]. But in general, the institutions like Ministry of Economy, as a central executive body responsible for the economic development policy (Charter 2.0.15: 'develops structure and innovation policy in the national economy and implements together with relevant state agencies'), as well as, State Committee for Standardization, Metrology and Patent (competition in the field of invention and patent, innovation fair), and the Copyright Agency are within the agencies which have an important role in the innovation policy. Besides that, 'The Science Development Fund under the President of Azerbaijan', established by the Presidential Decree dated to February 19, 2010, is a new institution supporting and partially implementing innovation policy. In the 'Objectives and duties' section of the Fund's charter, it is stated: "*The main objective of the fund includes the following: targeted funding of basic, applied and search-innovation type of scientific research programs and projects and other scientific events in the form of grants; as well as maintain and develop scientific-technical capacity in Azerbaijan through the implementation of actions which envisage the improvement and support the development of the functions of the scientific institutions; enhance the role of the science and engineering*

[26]The Institute for Scientific Research on Economic Reforms (ISRER) under the Ministry of Economy of the Republic of Azerbaijan. Final report on the scientific-research work on the subject 'Development of proposals and suggestions on the estimation of innovation activity and improving the efficiency of innovation activity in Azerbaijan', 2015 (pages 21 and 172)
http://ier.az/uploads/IIETI%20(YekunHesabat2015)%20aze.pdf

in the solution of important social problems and increase innovation resources"[27]. Aimed at importing the advanced technologies into the country and serving the development of science-intensive industry in the country, the *Research and Development Centre for High Technologies* was established within the Ministry of Transport, Communication and High Technologies[28]. A decree "On establishing a space industry and launching telecommunications satellites ' and State Program 'On the establishment and development of space industry' are the indication of the government's care for the development of space industry. First satellite of Azerbaijan, 'Azerspace-1' telecommunication satellite was launched into orbit in 2013[29]. State policy documents state that, these steps at the end are oriented on the 'development of innovation-oriented economy'.

High Technologies Park of the National Academy of Sciences was established in 2016 and is considered as 'an area with necessary infrastructure, material and technical base and management units for the implementation of scientific researches and experimental design works towards the design, development or improvement of innovation products or high technologies, and the application of their results in industry, service and other sectors'[30]. "*Establishment of a modern complex on the expansion of the innovation and high technology domains based on modern scientific and technological achievements and implementation of scientific researches and development of new technolo-*

[27]Akif Musayev. "Innovation Policy: European Union practice and adaptation opportunities to the Azerbaijani terms". Tax Magazine. No.5. 2010 (pages11-12). http://vergijurnali.az/upload/File/art-96.pdf
[28]"High technologies". http://www.mincom.gov.az/fealiyyet/yt/ (19.01.2017)
[29]"First national telecommunication satellite". http://www.mincom.gov.az/layiheler/ilk-milli-telekommunikasiya-peyki/ (19.01.2017)
[30]"The Decree of the President of the Republic of Azerbaijan on the establishment of the High Technology Park of the Azerbaijan National Academy of Sciences (ANAS)" (08.11.2016). http://science.gov.az/news/open/4508 (19.01.2017)

gies' is also in the list of goals. Along with the High Technologies Park in Sumgait, Mingachevir High Technology Park is established in Mingachevir city, which covers 1,31 ha area. 50 ha area was allocated for the establishment of High Technology Park in Pirallahi island[31]. Here the resident companies are granted with rooms, and they are provided with the study of local market, human resources and employment, consulting on the management issues and meeting with the investors and training programs. The concessions in Pirallahi island include an exemption from income tax, property and land tax exemption, exemption from VAT, access to business services, talented human resources and scientific circles for 7 years.

Priority areas include: *information technologies, software engineering, mobile technologies, e-business, animation graphics, robotics and mechanics, alternative and renewable energy, research on energy efficiency, space and telecommunications, biotechnology, medical software applications and LED technologies*[32]. PI Campus business incubator also started its operations within the HTP. In parallel with all these activities, the government finances some applied and basic researches and some innovative projects through the Science Foundation and State Fund for Development of Information Technologies. It is possible to further improve all these existing tools on the basis of the international practice. There are 'Innovations Centres' subordinated to the State Agency for Public Service and Social Innovations under the President of the Republic of Azerbaijan. The Centre was 'established with the purpose of the researches on social-oriented innovations, and application of innovative solutions by state bodies and business units"[33]. As well as 'Start-up Project' and Innovative Busi-

[31]High Technology Park (Pirallahi). http://hightech.az/why-htp/pirallahi/ (19.01.2017)
[32]"Branch of activities of High Technology Park". http://hightech.az/activity-spheres/ (19.01.2017)
[33]Innovation Center. General information. http://icenter.az/umumi-melumat/ (05.02.2017)

ness Incubator of State Economy University established for transformation of innovative ideas into the business are among the newly developed mechanisms[34]. Overall, along with the national innovation policy and strategy, each region should have its own separately developed innovation program[35]. Sumgait Chemical Industrial Park and Balakhany Industry Park – established in Azerbaijan – envisage the processing of oil-chemical products and solid waste. In all other regions, there is a need for the establishment of specialised industry and technology parks supporting the innovation activity[36].

6. INTERNATIONAL EXPERIENCE ON INNOVATION POLICY

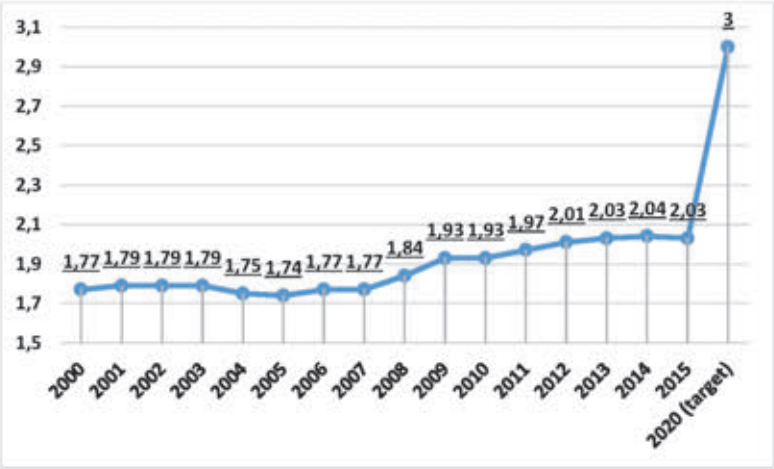
6.1. Innovation policy of the Eurpean Union

Europe 2020 Strategy sets the objectives of the Union regarding economic development and employment for the end of this decade. The Strategy emphasizes smart, resilient and inclusive development to mitigate structural weaknesses of the economy. At the same time, the European Union aims to build strong market economy by improving competitiveness and productivity. Besides goals on employment, climate change, education and social protection the Union also set important targets regarding innovation: "3% of the EU's GDP is to be invested in research and development, which will create opportunities for innovation in 2020"[37]. R&D, innovation and

[34]Amrah Garayev. "Report on the international experience in supporting the establishment of industry-oriented new small and medium sized companies (start-up)". Ministry of Economy and Industry. Baku 2015 (pages 26-31)
[35]Paul J.J.Welfens. "Innovations in Macroeconomics". 3rd ed. Springer-Verlag Berlin Heidelberg 2011 (p.349).
[36]Economic Cooperation Organization. "Economic Journal". Issue 5, December 2013 (p. 12).
[37]"Europe 2020 strategy"
https://ec.europa.eu/info/strategy/european-semester/framework/europe-2020-strategy_en

efficient use of energy will make the EU economy more competitive and create new jobs.

Figure 5. Ratio of R&D or Innovation expenses to the GDP (%)

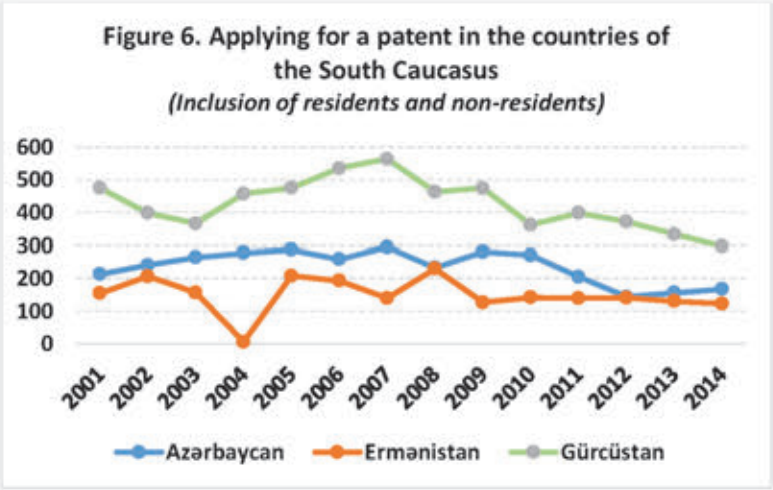


Source: Eurostat

Each member country sets its national goals for the full implementation of the Strategy in the EU level. EU statistics offices, Eurostat and EU Commission monitors and develops reports on progress of the strategy. According to the official definition of the EU "Innovation is a new or significantly improved process, product, marketing solution or management mechanism introducing new values to the society, market and the government."

Innovations are important for the European economy to boost its competitiveness in the global economy. The EU implements policies and programs for increasing investments on research and development and using the innovative findings to produce improved goods, services and processes for the market. Competitive innovations are especially important for the EU's industrial policies. The industrial sector accounts for the 80% of the European exports. 65%

of the research and development investments of the private sectors is from the industry[38]. By modernization of the industry Europe means successful commercialization of the innovations in products and services, exploitation of innovations in production technology and development of innovative business models. Research conducted in Europe revealed that enterprises applying innovations have larger cash-flow. Thus, 79% of the companies that had applied at least one innovation since 2011, had experienced 25% increase in their cash-flow by 2014[39].



Source: Metadata information of the World Bank (http://data.worldbank.org/)

Innovation index and assessment matrix covering special indicator systems (*Summary Innovation Index / European Innovation Scoreboard*) is used for comparative evaluation and measurement of the

[38]"The importance of innovation". https://ec.europa.eu/growth/industry/innovation_en
[39]"Innobarometer 2014". https://ec.europa.eu/growth/industry/innovation/facts-figures/innobarometer_en

innovation and scientific research performance of the EU member states. Innovation indicators consist of 25 indices from 3 categories and 8 directions. Especially, efficiency of R&D expenses and its share in the GDP, as well as venture capital and its share in the GDP are the main indicators for transition to the knowledge economy, production of new (more risky) technologies and in the long term ensuring intransigent economic development. Efficiency of the R&D expenses is measured with the number of patent applications. If we compare the dynamics of the patent applications in the South Caucasus, even with the declining tendency Georgia has comparable level with the EU countries. In comparison to the other two countries of the region Georgia has favourable conditions for the business environment and as a result the number of non-resident patent applications have surpassed the number of resident patent applications in the last 4 years.

EU's innovation policy is especially addressed to the small and medium-sized enterprises. The reason is that, small and medium-sized enterprises face more financial restraints in introduction and commercialization of innovations (*71% of the small and medium-sized enterprises face financial problems in application of innovations as opposed to 48% of large enterprises*). New development opportunities as a result of provision of new products and services can be achieved through technological advancement, new processes and business models, innovations and non-technological improvements in the service sector. This policy should be in wider context reviewed together with youth creativity, talent and goal of innovation.

The EU has strengthened its policy in direction of increasing investments for innovation. "Horizon 2020" program will provide approximately 80 billion Euro to research and development. At the same time, in framework of 2014-2020 program of perennial financial plan, at least 100 billion Euro will be open for the use of the members of the European Structure and Investment Funds for financing of inno-

vation investment in parallel to the priorities of the industrial policies.

These investments will be used in framework of "Smart specialization" for concentrating in provision of comparative advantages and promotion of value chain of the member states and regions. Cross-cutting strategic areas are identified in this framework: high-tech manufacturing, biotechnological products, clean vehicles and vessels, raw materials for sustainable construction, smart network and digital infrastructures.

6.2. Innovation policy of turkey

As a G-20 member country and 17th biggest economy of the world, Turkey has prioritized development of innovation economy in the recent years and has implemented continuous state policy in this area. The main vision of "Turkish Industrial Strategy Document (2015-2018)" is "becoming the designing and production centre of Afro-Eurasia in upper-middle and hi-tech products"[40]. The main target of the strategy is: "By increasing competitiveness and productivity of the Turkish industry to gain more share in world exports and mainly to increase transition speed of the industrial system which creates high additional value, produces hi-tech products, develops quality human resources and at the same time is sensitive to the environment and problems of the society"[41]. Strategic documents are identified as the following:

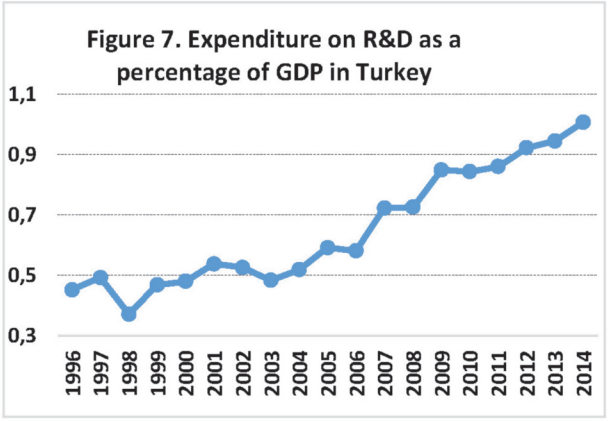
- *Target 1: To improve high value added domestic production based on knowledge and technology industry*
- *Target 2: Ensuring transition to the green and competitive industry with efficient use of energy;*
- *Target 3: Development of the industry with quality human resources contributing to the social and regional development.*

[40]"Science, Industry and Technology Ministry – Turkish Industrial Strategy Document (2015-2018), 2015 (page.20).
[41]Ditto page 44.

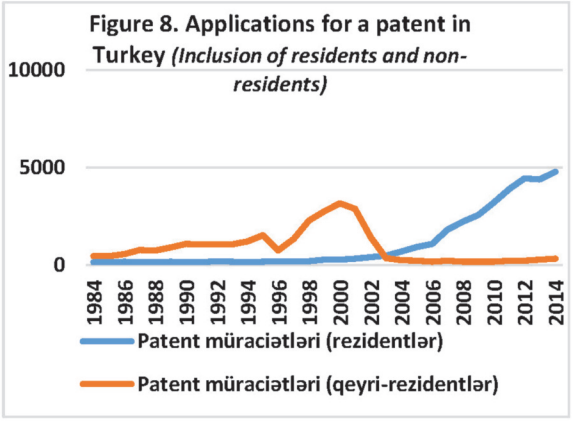
The aim of the vision is to set strategic targets, which in their turn define industry policies, which in their turn identify action plans in the strategic document. *Support of the public sector to the R&D and innovation, as well as its guidance for the private sector, the latter's initiative in R&D and innovation provides competitive advantage and branding in global level. Countries developed in production of high value added products using R&D and innovation are more successful than developing countries. As opposed to this tendency, developing countries like China, India and Brazil use technologies of the developed countries to create their own special technologies. As a result of this development, these countries are moving in direction of becoming significant production centres of the world for knowledge based technology.*

Wide and diverse manufacturing base of Turkey, with strong international relations and cooperation, producing export oriented products stepped into fast development period with introduction of new economic environment in 2001. Textile products, clothing, metal industry products, as well as products that are not classified anywhere else, such as machine supply, land vehicles with engines and harnesses are the leading exported products of the manufacturing industry of Turkey. Turkish government assess strategies implemented for transition from low-tech production to middle-tech production as guidance for transition to hi-tech production. The main aim of the current period is to increase the effect of recently accelerating innovation investments in industrial production. Number of patent application, which are seen as the main indicators of innovative development and scientific and technological innovation, have been increasing among Turkish residences. Number of applications by non-residences had decreased in the beginning of the 2000s and became stagnant since then.

Automobile, machinery and equipment, information and communication technologies are considered as the most R&D and innovation capable areas of the country in National Science, Technology



Source: WB (http://data.worldbank.org/country/turkey?view=chart)



Source: WB (http://data.worldbank.org/country/turkey?view=chart)

and Innovation Strategy (2011-2016) – the main strategic document comprising the countries science, technology and innovation visions, priorities and targets for the next 6 years. Energy, water, food, defence, space and health sectors are also considered as priority sectors where R&D and innovation activities are needed to be increased. The share of research and development (development of prototype products), including innovation expenses in GDP continuously increased in the recent years exceeding 1%. Besides this indicator, another critical indicator of science and innovation based economy, number of articles published in science and technology journals increased yearly, exceeding 30,000 and annual total number of applications for the trade marks exceeded 111,000. Integrated innovation policy implemented in leadership of the Ministry of Science, Industry and Technology in cooperation with government bodies, universities and entrepreneurs has given its results.

One of the successful models of Turkey for providing university-enterprise cooperation and establishing innovative companies, "Gebze Technopark", was established in Kocaeli city of Turkey, reaching 150 million dollar annual turnover (there are 64 technological innovation zones in Turkey with 4200 enterprises and 41000 employees, reaching annual export of 2.4 billion dollars and annual 1125 patent applications) [42]. Especially small and medium-sized enterprises are established in this kind of technoparks and adopt hi-tech, start export-oriented production, create employment opportunities, even attract foreign investments. Technopark offers infrastructural support and additional services to the newly established enterprises.

Strengthening commercialization phase of technological production, implementation of activities directed to technology transfer, development of innovative entrepreneurship, transition of public

[42]GOSB Technopark. http://www.gosbteknopark.com/ (01.02.2017); Turkish Standards Institute (TSE).

procurement to the system which supports technological advancement, development of technologies supporting productivity and sustainable production process and the need for increasing the share of hi-tech sector in manufacturing and exports remain significant to this day[43]. The role of this kind of innovative infrastructure accelerates the process of reaching to the above mentioned goals. Activities were carried out to improve access to the financial resources by small and medium-sized enterprises prioritizing innovative activities. By providing share purchases, as well as directing enterprises towards their strategic goals and by improving their productivity private equity, enterprises create opportunities for investors and small and medium-sized enterprises which have difficulty to grow by cooperating and providing finances. KOSGEB, helping small and medium-sized enterprises, provides interest rate support to indebted innovation enterprises by offering interest-free loans or providing financial aids to new companies in the stage of establishment. At the same time, mechanism for implementation, monitoring and assessment of industry strategy with innovation elements was established in Turkey.

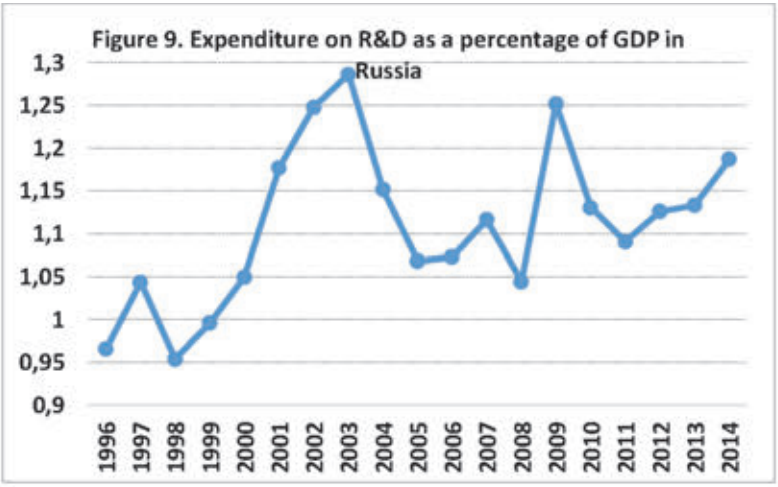
6.3. Innovation policy practice of Russia

"*Strategy of Innovative Development of the Russian Federation until 2020*" approved by the Government of Russian Federation on December 8, 2011 has been prepared in response to the challenges of innovative economic development of the country based on the long-term socio-economic development conception and Federal law on "Science and scientific and technical policy"[44]. Key financing centre for research and development in Russia is a federal government

[43]Sumit Kundu, Surender Munjal (Eds). "Human Capital and Innovation: Examining the Role of Globalization". Palgrave Macmillan. 2017
[44]"Strategy of Innovative Development of the Russian Federation until 2020" (08/12/2011). https://rg.ru/pril/63/14/41/2227_strategiia.doc

budget through federal programs and government fund for financing of science.

Main institutions of innovative development have been established rapidly in recent years: (a) Foundation for Assistance to Small Innovative Enterprises; (b) Venture funds of which the government is a co-founder via "Russian Venture Company" OJSC; (c) Federal government autonomous institution "Russian Foundation for Technological Development"; (d) "Ros-Nano" OJSC; (e) "The Bank for Development and Foreign Economic Affairs" ("Vneşekonom-bank"). The special focus is given to research and innovative development in higher education institutions. 29 universities in the country have been given the status of national research university and they are supported towards the establishment of innovation infrastructure. In Russia important measures have also been taken towards establishment of university clusters in the recent years. "*University-private sector partnership*" owns a serious role especially in the improvement of com-



Source: http://data.worldbank.org/country/russian-federation?view=chart

puter software sector and annual export levelling up to 7.6 billion dollars in 2016[45]. The first national research centre of Russia will be established under the "Kurchatovskiy Institute".

As a supportive infrastructure to innovations the followings are being established: special economic zones which will be in the advance of technological activities, use of special discounts systems for innovation companies, scientific awards system, technoparks, business incubators, technology transfer centres, centres for collective use of scientific and research equipment, innovation clusters selected and improved based on competition. "Skolkovo" innovation complex is a centre for application of special legal framework, minimizing the administrative barriers and taxes. However, all these and planned measures do not guarantee positive expectations for Russia, the country depending on natural resources, with regard to becoming a leading actor in the world proprietary technology market (its domination in military technology is a fact).

Loren Graham, one of MIT professors, in "*Lonely Ideas. Can Russia Compete*?" book investigates the reasons of current technological lacks of Russia, the country with historical great achievements in science and art. The author concludes that the development via technological innovations should be a natural development path of the society. In other words, any individual's innovative idea with serious commercial potential is not enough. We need a community supporting the innovations and inventions, and being inspired with these. *Innovations develop and gradually commercialized not in vacuum, but in psychological, socio-economic, legal and political environment.* Therefore when talking about innovative development, we should mention not the laboratories, but the property rights, legislation on patents, corruption level in government administration, community attitude

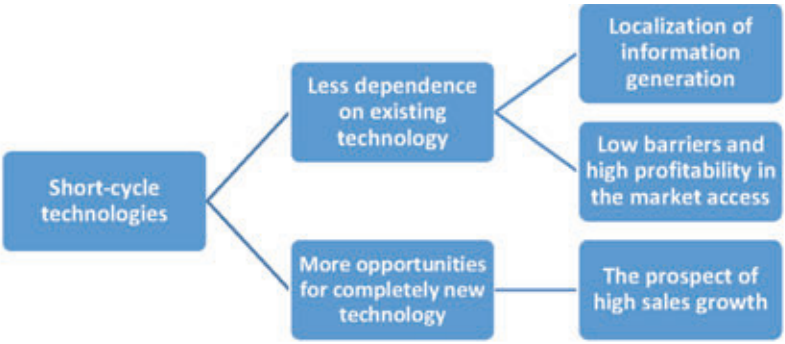
[45]Алексей Грамматчиков. "Кадры решают почти все". Специальный доклад. "Сделано в России". Журнал «Эксперт». №14 (1024) 3 апреля 2017. http://expert.ru/expert/2017/14/kadryi-reshayut-pochti-vse/

towards inventor businessmen, qualitative education system merging the training and research, and political rights[46].

6.4. South Korea and Taiwan experience: short cycle technologies as an Alternate technological innovation advance

Keun Lee (2013), main South Korean author of an approach to focus on short cycle technologies, notes that if trade-based specialization is important in the sectors where developed countries are not dominant (*low technology and raw material based intermediate products*) in order to become middle income country from low income country, but in order to become high income country from middle income it's important to specialize in short patent period or *short-cycle* technologies where new technologies enter more intensively to the market[47].

Scheme 3. Technological specialization criteria and advantage of short-cycle technologies



Source: Lee (2013), p.145.

[46]Loren Graham. "Lonely Ideas. Can Russia Compete?", The MIT Press, London, 2013 (səh. 9).
[47]Keun Lee, "Schumpeterian Analysis of Economic Catch-up. Knowledge, Path-Creation, and the Middle-Income Trap". Cambridge University Press. 2013 (p. 24).

Short-cycle technologies are those technologies which are less dependent on outdated or obsolete, previous generation of technologies and to which new technologies can be applied more quickly (*f.ex., here include electronics and other related products where South Korea and Taiwan are specialized*). Some examples of short-cycle technologies based on South Korea and Taiwan include: *electric semiconductors, TVs, transistors, solid-state diodes, land vehicles, lightning means, static data storage devices, magnetic dynamic data storage devices*. Since the midst of 1980s South Korea and Taiwan distinguished their technological specialization from other middle and even high income countries and focused mainly on short-cycle technologies. However, only after being specialized in averagely 15-years short-cycle technologies sector, these countries attained necessary technological skills and practices, focused on and succeeded in more value-added, high patent cycle technological sectors. Remaining and specializing in short-cycle technologies sector during certain period enabled these countries to further increase innovation (R&D) expenditures, number of researchers in research and development sector. In Azerbaijan's innovation policy this option could be considered which is based on Korea and Taiwan innovative model. In the so-called *"Developmental state"* model, a successful one in some countries like South Korea, the government realizes the industrialization and innovative economic development via ***local companies*** fully supported by the government[48]. And Taiwan is the world leader for the number (323) of patent applications per million persons. Taiwan's "*Hsinchu Science and Industrial Park*" technology park has innovative firms such as Acer, Kingston, Giga, Logitech, MediaTek, TSMC, Zyxel[49].

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[48]Kanan Aslanli. "South Korea Model for Azerbaijan?". "Sumqayıt Xəbər". January 23, 2016
http://sumqayitxeber.com/arasdirma/azerbaycan-ucun-cenubi-koreya-modeli.html

[49]Tayfun Yıldız. "Türkiyede teknokentler ve inovasyon". TSE. "Standard" Ekonomik ve Teknik Dergi. No.647. Ekim 2016 (sayfa 51).
https://www.tse.org.tr/upload/tr/dosya/icerikyonetimi/7610/28112016161147-2.pdf

7. GOVERNMENT INNOVATION POLICY AND PRIVATE SECTOR COMPANIES

Goals, targets and promotional tools (tax benefits, credit support, infrastructure redesign etc.) of government's investment policy shall involve the private companies in increasing their innovation expenses. Studies show that the incomes of companies directing more than 25% of their R&D budget to various types of software are growing more rapidly compared to their competitors. Innovation (R&D) allocations of 1000 huge corporations having the greatest R&D allocations in the world were increased 0.04% in 2016 and reached to ***680 billion dollars***[50]. In 2018 it's expected that ***health sector*** will get ahead of computer and electronics sector and become a huge unique sector for the volume of R&D expenses. Let's look at the rating and division according to different criteria of 20 international companies who had most innovation (R&D) expenditures in 2016. These companies are usually from the USA, Germany, Switzerland, Great Britain, Japan and South Korea, and they operate mainly in computer and electronics, software and internet, autocar and health sectors. Their annual R&D expenditures varies in the range of 6-13 billion dollars.

Table 3. Companies who had more innovation (R&D) expenditures in 2016

2016 rating	Company	Country	Industry	Innovation (R&D) expenditures (billion $)
1	Volkswagen		Autocar	13.2
2	Samsung	South Korea	Computer and electronics	12.7

[50]PWC. "2016 Global Innovation 1000 Study".
http://www.strategyand.pwc.com/innovation1000#GlobalKeyFindingsTabs3

3	Amazon	USA	Software and internet	12.5
4	Alphabet	USA	Software and internet	12.3
5	Intel Co	USA	Computer and electronics	12.1
6	Microsoft	USA	Software and internet	12
7	Roche	Switzerland	Health	10
8	Novartis	Switzerland	Health	9.5
9	Johnson & Johnson	USA	Health	9
10	Toyota	Japan	Autocar	8.8
11	Apple	USA	Computer and electronics	8.1
12	Pfizer	USA	Health	7.7
13	General Motors	USA	Autocar	7.5
14	Merck	USA	Health	6.7
15	Ford	USA	Autocar	6.7
16	Daimler	Germany	Autocar	6.6
17	Cisco	USA	Computer and electronics	6.2
18	Astra-Zeneca	Great Britain	Health	6
19	Bristol-Myers Squibb	USA	Health	5.9
20	Oracle	USA	Software and internet	5.8

Source: http://www.strategyand.pwc.com/innovation1000

Government shall promote the *"public-private sector partnership - PPP"* in the innovation policy. It should be worked with technical and knowledge support, so that innovation strategy becomes a component of overall business development plan evaluated constantly. Innovation strategy shall be crafted in line with the market demands and manufacturers' expectations. Company gathers information on special innovation efforts by regularly reviewing the external ideas in the sector itself or other industrial spheres, identifies new opportunities and enhances the knowledge of organization. Company shall benefit from all internal and external capacities for commercialization of intersectoral ideas. Corporations shall collaborate with current and potential suppliers, distributors, education institutions and service providers towards innovation needs and branding purposes with the government support. Organizations shall accurately manage their financing funds to implement their innovation agenda. *Appropriate measurements and risk management actions shall continuously optimize the investment portfolio and investment opportunities with different life cycle shall be re-considered.* It should be considered in the government innovation policy that the likelihood of failure and risk is very high in the efforts taken by individuals, groups or companies to make an innovative solution[51].

Innovation talent shall also be an important criterion in the performance assessment and human resources policy of organizations or companies. Decision-making systems shall be designed as flexible reaction capacity to innovation opportunities both in public and private sectors. Organizational culture shall support each employee for introduction of new ideas. Innovation policy shall be an outcome of the inclusive process comprising all and innovative behaviour shall be promoted as a value. Organizational environment shall be convenient for testing new ideas, conclusions should be drawn from

[51]Mark Dodgson, David Gann. "Innovation: A Very Short Introduction". Oxford University Press 2010 (p.13-17).

both successes and failures as a natural component of innovation process. Innovation capabilities and behaviours shall be constantly measured in digital platforms. A successful innovation policy at company level is based on supportive business environment. Weak business environment considerably increases the cost of new production and makes the amount of innovation profits indefinite, all these eliminate the incentives of firms towards innovative activities[52]. The firms introducing one or more new products tend to be more sensitive to quality of business environment compared to non-innovative firms.

The differences in "*perception*" of firms with regard to business environment tend to be higher while assessing the corruption, skills of labour force and trade-customs regulations. These differences are relatively small in Central Europe and Baltics, but high in Central Asia, Eastern Europe, Caucasus and Russia including Azerbaijan[53]. In these countries an overall business environment may support innovations. Looking at the driving force of innovations we see that the firms tend to be more innovative in those countries where major economic institutions (low level corruption, rule of law, more openness to trade and investment, high skilled personnel) have been established. Easy access to finance resources and ICT infrastructure also renders assistance to the firms in their innovation activities. Innovative start-ups are more or less in the transitional countries. Contrary to the countries like Israel, the young people and small firms in the countries of our region have less interest in global technological novelties and innovations compared to large firms. More creative youth and innovation firms make *innovation drain* to the countries enabling start-up environment like USA. Less number of

[52]"Innovation in Transition". EBRD Transition Report 2014 (p.5)
[53]D.A. Dyker, S. Radosevic (Eds.) "Innovation and Structural Change in Post-Socialist Countries: A Quantitative Approach". Springer, Nato Science Partnership Subseries: 4, Vol. 20 (1999)

innovative start-ups in the transitional countries like Azerbaijan informs about the difficulty to be ahead of the front of these technological novelties in near future. Some reasons of less number of innovative start-ups:

i) specialized funding mechanisms (risk tolerant "angel investors", venture and "seed capital") do not exist;
ii) personnel lack the knowledge and skills;
iii) problems of competition environment impeding the influx of new firm in the market;
iv) weak protection of intellectual property rights;
v) people at the top level management of companies tend to stay away from the technological progress.

Meanwhile, there is a direct connection between the size of firms and their active involvement in innovation (research and development) activity. Thus, larger firms are able to easily finance the high-cost research and development projects.

8. PROBLEM SOLVING POLICIES: GOALS AND POSSIBLE MEASURES OF INNOVATION POLICY

Innovation policy of a government shall cover the establishment of clusters supporting innovation system. Innovation system is a network of public-private sector institutions of which the mutual operations provide the development, modification and application of new technologies. And cluster is a sectoral and geographical concentration of enterprises which improves the innovative performance of firms. The firms operating in the same cluster learn the technology transfer and innovations from each other and collectively[54]. ***In the developed countries the primary goal of government's***

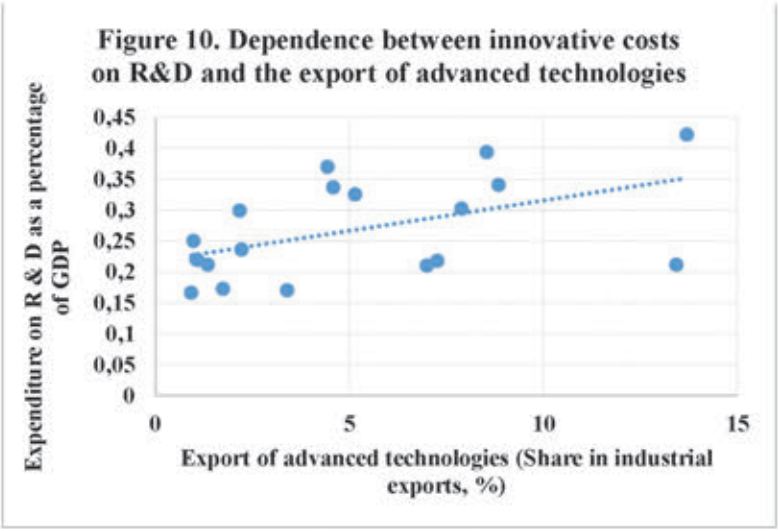
[54]Banji Oyelaran-Oyeyinka, Dorothy McCormick, "Industrial clusters and innovation systems in Africa: Institutions, markets and policy", United Nations University, 2007 (p.4)

innovation policy is to improve more the firms' technology absorptive capacity. Technology absorptive capacity is the built-in capabilities of firms to apply optimally the current knowledge and technologies in order to reveal new knowledge and technologies. Learning the application of new technologies is a must to improve the efficiency and competitiveness of business operations, make technological changes in firms (sectors). Various types of "learning" processes form the competences of firms needed for adaptation of simpler technologies at primary stage. But the application of more complex technologies requires more complex competences and R&D costs.

Passing all these stages and realizing innovation-based activities depend on several internal and external factors. Internal factors *are relating with the firm or system itself, and cover the following elements: essential skills of human resources; financial capabilities; relevant physical capabilities; information flow; intrafirm technology learning capabilities (number of skilled staff); trainings for staff; university-industry mobility*. External factors influencing the firms' innovations and learning the use of new technologies are*: commercial and technological licensing capabilities that might be attained by local and foreign sources; international quality standard to which the local firms conform; produce the high value-added productions and integrate the global "value chains"; get benefit from new technologies directly spreading as a side effect of domestic investment*.

Both factors enhance the capabilities of firms towards technology learning and production ("*innovation is a produce of learning process and tradition*"). Firms, first of all, master the technological information, then direct it to the production. Firms join the innovation activities (R&D) when it has improved its "learning skills", staff prepared, the government has an effective research system, firm has a needed capacity for medium and high technological productions, there is an access to financial resources, there is a local and export

demand for medium and high technological productions. Therefore, along with the amount of innovation (R&D) investments at national level, how the increasing R&D costs are directed to the improvement of systematic factors promoting the technological absorption is also important. These systematic factors are as follows: *government's research capacity (hugeness and quality of sector), university education, centres of excellence, promotions towards academy-industry partnership (tax benefits might be applied to the firms participating in researches jointly with academic sector or cooperating otherwise in innovation sphere*). Meanwhile, it's necessary to have a look at the interaction between the GDP share of R&D funds and export of technological products.



Source of statistical data: The State Statistics Committee

While looking at the interaction between innovation ("R&D") expenditures and "high-tech" export, we can see a positive one, though not strong enough (***correlation rate 0.51***) I.e. generally, during the

years of high R&D expenditures the share of high-tech export was also high in overall industry export. The conclusion is that along with increasing the effectivity of R&D expenditures, the overall amount of these expenditures shall also be increased. ***In the developed countries the 2nd goal of government's innovation policy is to establish a unified "innovation ecosystem".*** Here includes the establishing the necessary institutions, providing the mutual relations between them and forming supportive infrastructure. Promotion of innovation ecosystems is possible through the collaboration and engagement of all supply-side actors (information and innovation institutions at enterprises, universities, research laboratories, test centre, technology and industry zones, incubation centres for start-ups, demand-side actors (competitive industry, agrarian, service enterprises, government agencies) and supporting actors (government, finance organizations and international organizations)[55]. This time the innovation policy effect depends on 3 factors:

1) *Establishment of high level government administration and efficient coordination mechanism* (it should be defined which government agency or agencies are entitled to formation of government innovation policy, control of its application and evaluation in Azerbaijan);
2) *Facilitation of an administrative process* (e-government and e-solutions, simplification of granting permits and patent documents, reduction of bureaucratic resistance towards innovations);
3) *Making relationships among innovation actors and strengthening these relationships* (joint research projects between industry and academic sector, even establishing joint ventures, academic program designs conforming to the needs of industry, developing the non-formal networks).

[55]Technology and Innovation Report 2015. Fostering Innovation Policies for Industrial Development. UNCTAD 2015, (p.22-25).

Governments can realize support actions towards direct innovations in their innovation policies. Firstly, financing of the R&D projects in the research sector can be included here. The second direction is an involvement of private investments in research and innovations (*venture capital, tax incentives, technological transfers, "industry-academy" partnership*). Indirect acceleration of innovations implies the formation of more favourable environment for innovative companies and companies seeking to invest in, enrichment of human capital by improving the quality of science and education.

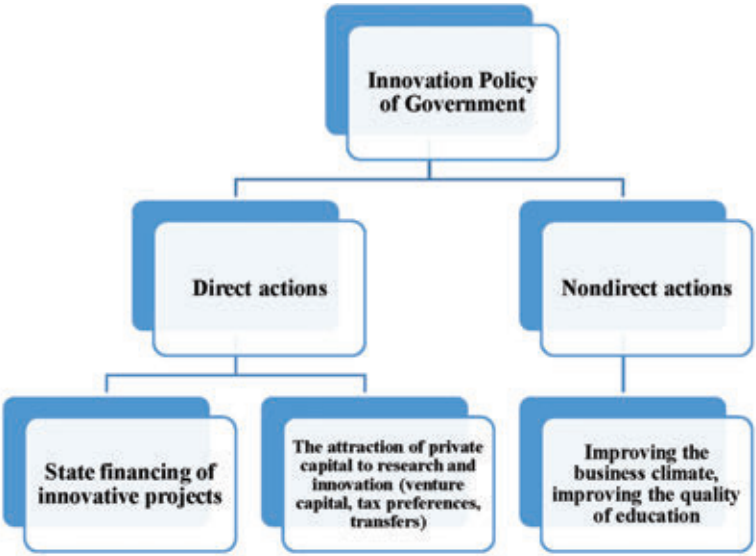
But in the transitional countries the goals and tools of innovation policy may be somehow different. Survey conducted by EBRD in 2014 revealed the following key goals of innovation policy in the transitional countries like Azerbaijan: (i) *commercializing the academic researches*, (ii) *improving the access of innovation projects to financial resources* and (iii) *improving the business environment*. ***Economic and financial tools of innovation policy*** are the followings:

- *Competitive-based financing towards research and development (R&D) in fundamental or industrial field;*
- *Supporting the technology transfer and decreasing the patent costs;*
- *Awarding grants towards joint R&D projects for strengthening the science and industry relations.*
- *Clustering policy, application of innovation vouchers, technology platforms and forums;*
- *Application of risk sharing, preferential borrowing, guaranteed lending and subsidies mechanisms in the financing of research and development (innovation) projects of private sector;*
- *Set up support schemes for technology spreading and technology adaption services;*
- *Use of tax benefits for innovations of private firms;*
- *Government support to venture and seed capital.*

- *Block grants for non-competitive based institutionalization of research organizations and universities;*
- *Prioritization of domestic innovative solutions and products in the state procurements.*

The government innovation policy shall consider the innovation cycle of all companies irrespective of the property types. Thus, in the first stage, the technology is purchased from external source and used; then thanks to learning that technology its modification is prepared; finally, innovative technologies are produced. Most necessary issue is an innovative incentive of companies, and this is related with competition and business environment.

Scheme 4. Innovation policy actions



"Innovation in Transition". EBRD Transition Report 2014 (p.83).

Moreover, there should be government innovation institutions might be needed by private sector in R&D (*f.ex., special measurement laboratories*). While increasing the overall development levels of

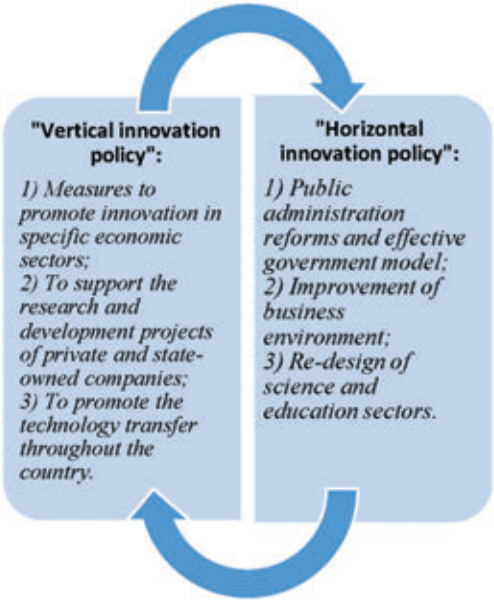
countries, they may form new innovative products and processes based on knowledge accumulated in certain fields. One of the most important issues is to redesign the higher education and especially engineering education, teaching of technical and natural sciences and adapt it to the market demands and government strategic objectives. Asian model (Taiwan, Korea) based on technology transfer of medium enterprises and European model based on fundamental sciences can be distinguished as innovation models[56]. Azerbaijan has a huge potential to conduct fundamental researches in several technical and natural sciences, financing the research conclusions is a major problem. Information directly gathered from the companies shall be used in the innovation policy design, formation of objectives and duties[57]. I.e. ***sector representatives should participate in the innovation policy design and objectives should be formed in response to the problems. Azerbaijan needs a seriously monitored unique document covering the long-term objectives and strategic duties of government innovation policy***. But in general, the execution of every strategic document or government policy depends on overall quality of government administration. From this standpoint, effective innovation policy ruires qualitative government administration apparatus (*independent of interest groups*) and advance business environment reforms. These are "*horizontal innovation policy*" actions. "*Vertical innovation policy*" actions cover definite sectoral and direct innovation programs[58].

[56]Irina Olimpieva. "Innovative Entrepreneurship and the Post-Soviet Path-Dependency of Russian Science". Russian Analytical Digest No. 155, 23 September 2014 (p.15)

[57]"OECD Innovation Strategy 2015: An Agenda for Policy Action". Meeting of the OECD Council at Ministerial Level Paris, 3-4 June 2015.

[58]"Innovation in Transition". EBRD Transition Report 2014 (p.87).

Scheme 5. 2 Directions of government innovation policy

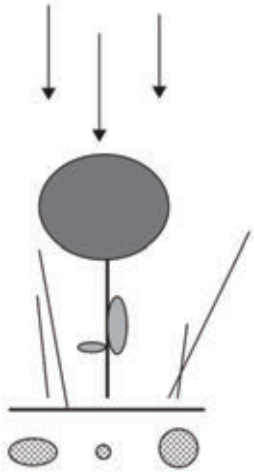


Horizontal and vertical innovation policy actions to be implemented may contribute to the establishment of "***innovation ecosystem***" (*innovative individual, innovative company and innovative government*) together with necessary modifications to be made in regulatory acts. Education system is important in the formation of innovative individual, competitive environment is important in the formation of innovative company and reforms of bureaucratic apparatus are important in the formation of innovative government. Here ICT, power, medical service stands out among the priority sectors in the transitional countries like Azerbaijan. Upcoming actions to be realized may include *the direct support to the innovative research and development projects of the companies* operating in this field. A special government agency may also be established for funding the innovation projects. For instance, investment support to R&D proj-

ects of private sector by *"Tekes" - Finnish Funding Agency for Innovation* has double multiplied effect. There is 20% increase in the annual turnover of those firms, 17% increase in the number of newly hired personnel[59]. I.e. the innovative companies become driving force of innovation activity[60].

The countries in different stages of development differ for their capabilities to use and produce knowledge and technologies. These capabilities are related with institutional quality, macroeconomic stability and effective operation of different markets (products, labour, funding). In order to attain existing technology, total absorption of its use and produce a new technology, the countries are required to meet the specific terms. Azerbaijan and other countries in transition lag behind the developed countries for the absorption and production of technology. These countries have identified the production of new technology as a goal of their innovation policy. Nevertheless, innovation policy shall be compiled by considering the real potential of countries. A new "*Silicon Valley*" might be targeted by enhancing the development of high-tech industries and government contribution to the innovation performance of research organizations. Nevertheless, a unified innovation policy model based on innovation policy of te developed countries may not be acceptable for all countries. So, improving the absorption capacity of new and modern technologies shall be prioritized. To this end, we need more economic openness, better secondary vocational education and professional training system, better management practices, elimination of impediments of lending.

[59]European Commission. "Research and innovation as sources of renewed growth". Brussels, 10.6.2014, (p. 8)
[60]Jouko Nikula, Ivan Tchalakov. "Innovations and Entrepreneurs in Socialist and Post-Socialist Societies". Cambridge Scholars Publishing. 2013



Land irrigation (*funding and other supports towards innovators*)

Weeds clearing (*competition environment and effective clearing*)

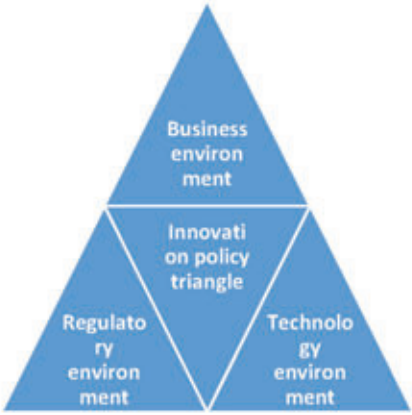
Increasing the soil fertility (*research and information dissemination*)

Preparing the soil for planting (*new education system design*)

While the technology development level is increased, the innovation policy shall also be accordingly revised. Along with the certain sectors, institutional and chronic structural impediments of all economies shall be gradually eliminated (measures such as effective regulations, improve the quality of human resources). Government shall gradually form an outcome-oriented framework in the innovation policy. Especially the development of an environment for promotion of innovation initiatives is important and from this standpoint the followings can be found as the functions of innovation policy[61]: support to innovators through appropriate promotions and mechanisms; elimination of impediments of innovative initiatives; establishment of active research institutions; inspiration of population for creativity through education system. The role of government's innovation policy can be compared to the gardener cultivating the soil as in the description above.

[61]The International Bank for Reconstruction and Development/World Bank. "Innovation policy: a guide for developing countries", 2010 (p.60)

Scheme 6. "Innovation policy triangle"



Government may promote new technologies via large state programs or special zones accumulated by talents (innovative enterprises). According to other approach to innovation policy, the innovation policy can be imagined as a triangle composed of business environment, regulatory environment and technology environment (described in the above Scheme 5). *The followings come to the fore: as elements of business environment - competition environment, access to funding, capital market, management practices; trade framework, pro-innovative tax system, rule of law and transparency, business doing and regulation of labour market as elements of regulatory environment; and in the technology environment the education and technological skills of labour force, technological researches and ideas commercialization infrastructure, digital technology infrastructure and ecosystem*. Strong technical-applied sciences, technology, math and engineering education make grounds for establishment of an innovative system.

In the coming period technological advancements are expected to cumulate in some areas (information technology, automatisation and hi-tech production, and healthcare technology) and shape the development in economic, social and military sectors. Especially, digital communication, nanotechnology, material sciences, measurement equipment, bio-tech-

nology and environmental technologies are fast developing areas. Nanotechnology and biotechnology will not only provide new opportunities but also be in the centre of attention for environmental and ethical questions. Creating high value added in global architecture is dependent on the factors such as specialization, application of new technologies and capacity to innovate. Growing volume of the economy is happening in parallel with the growing number of companies continuously developing their potentials and competitiveness. Continuous development of human resources, widening use of information-communication technology and prioritization of innovation are the ways to increase per-capita income of the country. Main determinant of the competitive power of the manufacturing company is not only perfectly efficient production, it is also the performance of the company in design, logistics and delivery services. Industrial policy is becoming more horizontal and non-production stages of the value chain, such as service and support activities are also covered. Production factors are significant for the balanced economic development. Productivity centered approach can improve competitiveness and provide high and stable economic development. In this regard, besides technology, effective use of human resources is also necessary to increase productivity level in the manufacturing sector.

"***Innovation requires lifelong learning and practices***". There is a need for centres teaching and using Genrikh Altshuller's "TRIZ" method, Edward Bono's "6 thinking hats" (making innovative solutions with small groups of 6 people via relevant creative function for each member), Tony Buzan's *"mind mapping"* method and other approaches. *Genrikh Saulovich Altshuller*, a world famous inventor scientist and writer, living and working in Azerbaijan during Soviet Union period crafted the ***"inventive problems solving (TRIZ - in Russian - "теории решения изобретательских задач")***[62]. The author identified the universal 40 principles of algorithm of inven-

[62]Eunika Mercier-Laurent. "Innovation ecosystems". ISTE Ltd and John Wiley. 2011 (p.63)

tions solving creative solutions and contradictions of problems after analyzing ten thousands of inventions and patents (*e.g., changing the form of an object from symmetric into asymmetric, separation of whole into segments etc.*). TRIZ method proves the development of technical systems based on certain conformities and this can be used in making creative solutions in all fields. Abstraction allows the algorithm of innovative solution made in one field to be used in other field. In Baku where TRIZ method is taught and used there were a "Young Inventors School" (there were more than 500 inventors' schools in all Soviet Union during 1980s) and "Azerbaijan Inventiveness Creativity Public Institute". Such centres could also be opened in current period to restore this tradition of opening, improving and correctly directing the youth creativity potential. In some post-Soviet countries, especially in Russian universities the "*Innovativeness*" program is taught which give systematic knowledges on management of innovation activities including TRIZ theory[63]. One of the important points in such programs of which the use shall also be started in Azerbaijan is to help individual and group creative solutions or innovations to be redesigned in compliance with market demands. *Special doctorate scholarship programs can be established in order to conduct fundamental and applied researches in those fields needed by Azerbaijan industry. Promotional measures (joint projects, scholarship and research grants) preventing the talents' departure from the country and paving the way for influx of talents can be taken. The return of investments of government supported R&D varies in the range of 20-67%[64]. The application of tax credit practice which*

[63]Ilham Ahmadov (Director of Computer Centre at ASPU). "Management of Education Innovations"
Azerbaijani Teacher. January 31, 2014 - №04.
http://www.muallim.edu.az/www.old/arxiv/2014/04/49.htm
[64]Stephen J. Ezell and Robert D. Atkinson. "The Good, The Bad, and The Ugly (and Self-Destructive) of Innovation Policy: A Policymaker's Guide to Crafting Effective Innovation Policy". Information Technology and Innovation Foundation. 2010 (p.49).

has high multiplicative effect can also be considered. The measures such as: promotion of tax benefits and export of local innovative products for the import of goods used in the technology transfer, protection of intellectual property rights, facilitation of standardization, licensing, certifying procedures can also be conducted.

9. CONCLUSIONS AND RECOMMENDATIONS

In Azerbaijan the innovation expenditures did not only increased during financial welfare period, but in the contrary, the GDP share was diminished. Goals, targets and promotion tools of the government's innovation policy have not been reflected in the unified document as integrated with certain performance indicators of executing agencies. Azerbaijan needs a seriously monitored unique document covering the long-term objectives and strategic duties of government innovation policy. But in general, the execution of every strategic document or government policy depends on overall quality of government administration. From this standpoint, effective innovation policy requires qualitative government administration apparatus (*independent of interest groups*) and advance business environment reforms.

In the period when the rate of economic growth is diminished, there tend to be a need for measures stimulating especially technology transfer and R&D expenditures in some selected sectors. Azerbaijan may choose a strategy of producing more innovative products by attaining necessary technological skills and practices after specializing in *short-cycle technologies sector in averagely 10-15 years* based on Far East countries' experience (*South Korea, Taiwan*). Remaining and specializing in short-cycle technologies sector during certain period may enable the countries to increase innovation (R&D) expenditures, number of researchers in research and development sector. This option can also be considered in Azerbaijan in the sectoral priorities of the government's innovation policy.

Research and development (R&D) is understood as a scientific activity successively implemented in order to look for new fields for enhancing and using scientific knowledge. Business R&D tax incentives include the permits and credits, as well as other forms of favourable tax approach to business R&D spending. Income-based incentive, license and patent, standardization and certification are the other regulatory fields. If GDP share of innovation (R&D) expenditures increases additionally 1%, the economic growth rate would additionally increase more than 0.25% in the developed and developing countries. Bringing the GDP share of innovation (R&D) expenditures up to 2%, effective university-industry relationships, public-private partnership promotions in innovation actions might be key midterm goals of the government's innovation policy. The innovation concept should emphasize the value given to product by user and his\her own values, quality of business model along with the invention[65]. Otherwise, just increasing R&D spending do not promise either government or company a serious growth in sales and profits, market capitalization and shareholder income. Innovation shall solve both technical risks (i.e. at technology development stage) and market risks (at the product sales and use stage).

Innovation policy shall consider also the global trends. Thus, surveys show that according to R&D spending, the world leading sectors of period by 2018 will be artificial intelligence, *big data analysis*, bio-nanotechnology, information technology, bioengineering, individual medical diagnostics tools, nanotechnology, renewable energy, software, robotics[66]. According to the World Bank

[65]Tendayi Viki. "Why R&D Spending is Not a Measure of Innovation". 21/08/17.
http://www.forbes.com/sites/tendayiviki/2016/08/21/why-rd-spending-is-not-a-measure-of-innovation/#37bd45df4276
[66]Industrial Research Institute (IRI), Global R&D Funding Forecast 2016, R&D Magazine
https://www.iriweb.org/sites/default/files/2016GlobalR%26DFundingForecast_2.pdf

recommendations on innovation policy for the developing countries, the innovation policy shall be an obligation all over the government, innovator shall craft mechanisms identifying and supporting the individuals and companies, a regulatory framework shall be established which is necessary for venture capitalization, increase in research and development expenditures of both private and public sectors shall be stimulated mainly non-government and foreign finance sources, education system shall be re-designed as supporting innovative mind, foreign trade and investment actions shall be liberalized. The practice already started in Baku with regard to support towards prospective and innovative high-tech projects like *Open Innovations Start-up Tour* shall be enhanced all over the regions of Azerbaijan[67].

Horizontal and vertical innovation policy actions to be implemented may contribute to the establishment of "***innovation ecosystem***" (*innovative individual, innovative company and innovative government*) together with necessary modifications to be made in regulatory acts. Education system is important in the formation of innovative individual, competitive environment is important in the formation of innovative company and reforms of bureaucratic apparatus are important in the formation of innovative government. Here ICT, power, medical service stands out among the priority sectors in the transitional countries like Azerbaijan. Upcoming action to be realized may include the direct support to the innovative research and development projects of the companies operating in this field. A special government agency may also be established for funding the innovation projects. Innovation policy of a government shall also cover the establishment of clusters supporting innovation sys-

[67]In Baku the "Open Innovations Start-up Tour" will be held. "Azərtac" IA. 04.04.2017.
http://azertag.az/xeber/Bakida_Achiq_Innovasiyalar_uzre_Startap_Turu_kechirilecek-1047884

tem. Azerbaijan and other countries in transition lag behind the developed countries for the absorption and production of technology. These countries have identified the production of new technology as a goal of innovation policy. However, the innovation policy shall be developed by considering actual economic potential of countries and specializing degree for sectors.

Short, mid and long term actions recommended within "innovation eco-system" for innovative economy building and government's effective innovation policy:

Innovation policy actions	For short-term (up to 1 year)	For mid-term (within 1-5 years)	For long-term (more than 5 years)
For "Innovative individual"	1. Development of "State Innovation Strategy for 2018-2025" and state programs	1. Crafting a new competitive mechanism for financing innovative start up projects	1. Re-designing the secondary and higher education system as interactive, *learning-centered system*
	2. Scholarships for scientific researches in doctorate and master degrees	2. Developing the *"Counter Brain Drain"* State Program	2. Study tours to EU countries at least 1000 young and middle-aged technologists annually
	3. New payroll and pension for R&D and innovation staff	3. Developing and using mandatory vocational internships programs at universities	3. Establishing training centres in all regions for qualitative human resource supply

	4. Organizing Open Innovations Start-up Tours in all regions	4. Unified registry of innovation infrastructure subjects and the patents with high trading likelyhood	4. Uninterruptedness of education abroad at public expense in technical and natural sciences
	1. Development and adoption of "State Innovation Strategy for 2018-2025" and successive state programs	1. Tax and other benefits for those companies increasing research and development (*R&D*) spending at identified rates	1. Support to local companies and their products with a potential of internationally branding (*"AzQuality" model*)
	2. Tax benefits for import of technological transfer goods	2. Use of *tax credit* practice	2. Bringing the GDP share of R&D spending up to 1.5% by 2025
For "Innovative company"	3. Establishing Technological Transfer Centres in active pilot regions	3. Preparing draft law on "Venture capital"	3. Implementing "Venture Capital Investment Program" jointly with international donors
	4. Drafting model statute of Technological Transfer Centres	4. Establishing pilot Technological Transfer Centre at least in 2 regions	4. Establishing Technological Transfer Centres in all regions

For "Innovative government"	1. Mixed commission (public and private sector, academic sector and civil society) for innovation strategy	1. Development of "State Innovation Strategy for 2018-2025" and successive state programs	1. Establishing the Ministry of Science, Industry and Technology and regional innovation-knowledge centres
	2. Draft law on "Innovation activity and government innovation policy"	2. Regional social innovation competitions of Innovations Centre of SAPSSI	2. Bringing up Azerbaijan in top 50 countries rating in the global innovation index
	3. Preparing "key performance indicator" of the national innovation system	3. Continuous structural reforms based on "flexibility, innovator and openness" principles of government administration apparatus	3. Become a major manufacturing centre of mid-tech products in South Caucasus and Middle Asia
	4. Including "*TRIZ method*" in the curricula of state universities	4. Establishing "Public Creativity Centre" based on "*TRIZ method*"	4. Opening "Young Inventors School" in all regions
	5. Discussions on the techno parks and innovation zones to be narrower specialized	5. Rise in local universities' rating in the global rankings	5. Activating a specialized research university

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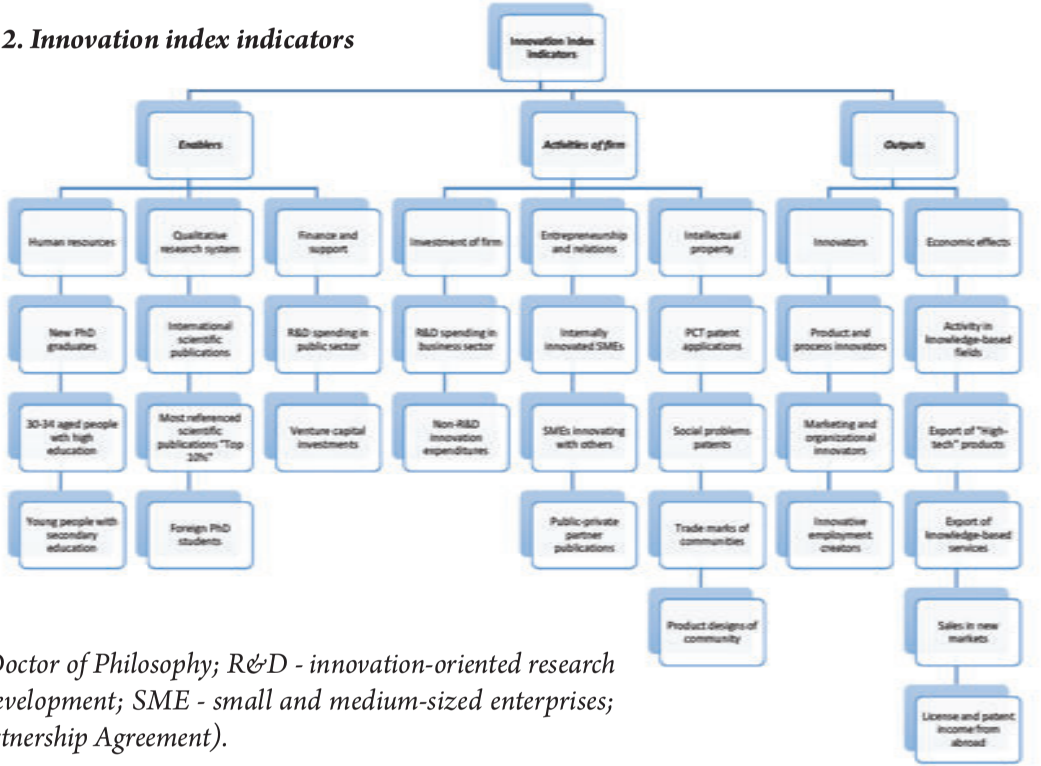
Annex 1. R&D spending in the developed and developing countries

Country	GDP share of R&D spending (%, 2015)	R&D spending per capita (USD, 2015)
Israel	4.3	1556
Korea	4.2	1466.3
Japan	3.5	1341.5
Switzerland	3.3	1561.2
Austria	3.1	1520.4
Denmark	3	1450.7
Switzerland	3	1709.4
Finland	2.9	1225.8
Germany	2.9	1381
USA	2.8	1563.2
Belgium	2.5	1126.9
OECD	2.4	974.9
France	2.2	915.3
Iceland	2.2	1045.7
Slovenia	2.2	707.6
Australia	2.1	991.3
China	2.1	297.4
EU 15	2.1	874.9
EU	2	753.8
Netherlands	2	999.5
Czech	1.9	657.6
Norway	1.9	1200.9
Great Britain	1.7	711.1
Canada	1.6	724.2
Estonia	1.5	433.8
Ireland	1.5	776.4
Hungary	1.4	364.6
Italy	1.3	496.1
Luxemburg	1.3	1339.3

Portugal	1.3	378.9
New Zealand	1.2	416.4
Slovakia	1.2	352.8
Spain	1.2	425.4
Russia	1.1	277
Greece	1	251.9
Poland	1	266.5
Turkey	1	200.2
South Africa	0.7	93.5
Mexico	0.6	98.4
Argentine	0.6	119.9
Chile	0.4	89.6

Source: http://www.compareyourcountry.org/science-and-technology

Annex 2. Innovation index indicators



(Notes: PhD - Doctor of Philosophy; R&D - innovation-oriented research and prototype development; SME - small and medium-sized enterprises; PPA - Patent Partnership Agreement).

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