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REVERSE INNOVATION: CAN INNOVATION FLOW FROM TURKEY TO DEVELOPED COUNTRIES?*

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Abstract

The term of innovation; is defined as the application of a new product, concept or known principle in a way that will create economic added value again presently. A nation's competitiveness depends on the capacity of its industry to innovate and upgrade. Companies gain the advantage against the world's best competitors because of pressure and challenge and achieve competitive advantage through acts of innovation. The term of "reverse innovation" which is a very new phenomenon, precisely emerges at this point. Reverse innovation is any innovation that is adopted first in the developing world. Reverse innovation is a special category of innovation. Particularly noteworthy is the fact that "innovation" is not contrary to the basic theories, but instead introduces a new action framework based on the same theories. Innovation will be an important opportunity and impetus in the development of poor countries. Moreover, the poor countries are megamarkets with micro-consumers. The purpose of this paper is to explore the potential of reverse innovation ability of Turkey and propose alternative techniques to penetrate new markets.

Keywords: Reverse Innovation, Competitive Advantage of Turkey, Reverse Innovation Advantages

INTRODUCTION

Since the early ages, the changes in social life and the environment have forced the human being and the formations he has formed to serve himself into a compulsive development process. There have been developments, changes, adaptations and innovations in every aspect of the evolution. This change in life has brought up the concept of business after a while. In the Agricultural Revolution, which is considered to have taken place around 8000 BC, the society has passed from the nomadic life to the established life and the most important element of the capital became the land. Thousands of years after that, production and transportation were made with the tools developed for the human and animal to use muscle power and to use this power more efficiently. So, during this period, the main means of production were soil and muscular power. In the traditional society based on agriculture, production was carried out in houses and handlooms. New technologies emerged together with Industrial Revolution gave birth to a new production environment and lifestyle. Such that; housing and business were separated from each other. Mass production in the factories changed urbanization and urban life. The way of life has led to changes and transformations in the sociological structure of society. The way of organizing in the factories have become effective for all areas of human life (Özdemir, 2014). The most radical transformations since the existence of human beings have been realized in the 20th century (Turunç, 2006). The first and last quarter of the 20th century was the period which transformation experienced the most intense changes with the revolutions of agriculture, industry and information technology. It has been an important period in which change and differentiation were observed unusually in the history of humanity in all fields.

Change is a process; moving from one state to another in a given time period; differentiation situation (Çınar, 2005) and is an operation which is bringing of personal information, talent, etc. to a

different position from the current without changing the location of the persons/objects (Koçel, 2005: 510). Perhaps one of the most important characteristics of human beings is not to be content with what exists, but long for the better. The impulse of searching better is the basis of development. However, this characteristic of the human being also consistents the necessity of change at the same time. A product or service previously described as "perfect" is described as "normal" when it is accustomed, and "inadequate" in the presence of a better one. Therefore, in order to be able to respond to the constantly rising expectations of customers/citizens, institutions must constantly renew and overcome themselves (Argüden, 2004). The main reason for the firms of changing demanding enterprises to initiate innovation is increasing awareness, appreciation, and sensitiveness levels of today's consumers. Nowadays consumers prefer high technology products in order to solve problems and increase the quality of life (Gürsu, 2014). This change reflected in consumption habits forces enterprises alteration. In other words, this change in society has confronted enterprises with the concept of innovation. Organizations today are focusing on new and/or improved products, processes, techniques or procedures to ensure competitive advantage and survive. In other words, it is asserted that enterprises can compete by constantly changing/renewing their products, services, production methods and their managerial understandings. In this context, innovation is one of the most contemporary words in science and technology world in recent years. (Eraslan et all., 2008). The word of "innovation", derived in England in the 16th century (Gürsu, 2014), is rooted in Latin words which are "inno-vare", "innovatus" (Turanlı & Sarıdoğan, 2010). At that time, the word meant "the introduction of new methods in social, cultural and administrative mechanisms" (Elçi, 2006). According to Oxford English Dictionary, "innovate: make changes in something established, especially by introducing new methods, ideas, or products" (http://www.oxforddictionaries...); according to Cambridge Dictionaries'e göre yeni fikir ve değişiklikleri uygulamaktır (http://dictionary.cambridge...). The meaning of innovation is that something new emerges unlike the traditional one. Innovation is not just reflected renewal, change or recency, but as Elçi (2006) has stated; refers to an economic and social system that depends on differentiation and change. In this context, innovation is not a separate activity on its own, but it covers all processes of science and technology effectiveness. What is meant by the word of innovation is the transformation of science and technology into a profit in terms of an intellectual theory, action and outcome, and transforming this benefit into a marketable output. Therefore, innovation is not a renewal phenomenon in a simple sense, but starting from the theoretical phase of renewal; it is a process that requires the inclusion of the innovation product (invention) and the ability to be marketable (Biçkes&Özdevecioğlu, 2011). The work which is the first document of innovation in the world and which declared administrative change is accepted as Magna Carta. The concept of innovation has ironically influenced its definition as much as it symbolizes change. In the meantime, the first meaning of innovation has changed. Until 1950, the notion of innovation was not a phenomenon discussed with a loud voice, but later it turned into a strategic conception placed at the root of global economic developmentIn the period of 1950-60, innovation skill is monopolized only by large enterprises, but now appears to be an effective element at a global level among the countries that are considered vital nowadays. The concept of innovation continues to be a candidate phenomenon for becoming a symbol of the inevitable change and development movement of a sustainable global competition for the future of mankind (Gürsu, 2014). As the world entered the 21st century, the new age brought very important changes. Especially the business, science and technology world is at the center of this changes. While new technologies and new discoveries have profoundly influenced human life, there have been radical changes in the basic working principles of the business world. The business world is heavily influenced by changes in the economic and social structure of the world (Soylu&Göl, 2010). As a result, in order to survive in today's increasingly competitive environment, enterprises need to constantly change, differentiate and renew products, services and methods of doing business. This process is called innovation (Elçi, 2006).

Schumpeter was the first economist who associated "innovation" and "entrepreneurship" (Ünlükaplan, 2009). Many definitions of innovation similar to or different to those of Schumpeter have been made up to date (Ersoy & Şengül, 2008). According to Schmookler (1966): "When an enterprise produces a good or service or uses a method or input that is new to it, it makes a technical change. The first enterprise to make a given technical change is an innovator. Its action is innovation." Knight (1967) defined 'innovation' as, "the adoption of a change which is new to an organization and to the

relevant environment. Freeman (1982) mentioned that " innovation is technical, design, manufacturing, management and commercial activities involved in the marketing of a new (or improved) product or the first commercial use of a new (or improved) process or equipment". Drucker (1985) argued that innovation as the effort to create purposeful, focused change in an enterprise's economic or social potential and is the tool of entrepreneurship. Innovation gives the ability to create new capacity from existing resource. Roberts (1987) argued that the invention process covers all efforts aimed at creating new ideas and getting them to work." Porter (1991) underlined this phenomenon as: "Companies achieve competitive advantage through acts of innovation. They approach innovation in its broadest sense, including both new technologies and new ways of doing things." Innovation is the process of transforming new ideas that have emerged(Mercan & Göktaş, 2011), into the commercial business by adopting the market successfully (Koç & Mente, 2007). Another globally accepted definition had been made in the Oslo Manual (2005) published by Eurostat as "an innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations". Countries are due to turn new ideas into technical and commercial success in order to sustain economic growth, competitive power and employment opportunities (Oğuztürk&Türkoğlu, 2004). Having an effective national innovation system and the advanced ability of innovation puts a country in a sustainable economic development process and increases its power of competition (Işık&Kılıç, 2012). The growth of the overall productivity of labor and capital in some countries like Australia, Denmark, Ireland, Finland, Norway, and the USA etc. is associated with significant technological developments. The increase in labor and capital productivity is also due to managerial practices, organizational changes, improvements in the production of goods and services (Ünlükaplan, 2009). Growth is higher in some countries like Ireland and South Korea, which continue to use technological innovation as an important tool in catching developed countries. Innovation contributes greatly to employment increase. Unemployment rates are falling in countries that have achieved high growth rate with innovation, whereas unemployment is increasing in countries where innovation growth rate is falling. While Innovation-based growth reduces income inequality, as is the case in the United States, also provides a higher employment rate for workers who are not qualified (Elci, 2006).

Studies carried out within the scope of the UN's Millennium Project reveal that accomplished science, technology, and innovation is one of the essential factors for the development of humanity. Innovation would affect health, environment, agriculture, communication, gender equality and the living standards of humanity positively (UNDP, 2001). Nowadays, the only factor that determines the competitive advantage is no longer costs. Many factors such as speed to respond to market needs, shortened product lifecycles, product and service quality, design, development of new products and services, product and service production according to customer requirements, new management and organization models, are much more important than costs. All factors above require innovation (Elçi, 2006). The underlying cause of the forces of developed economies of the world is the ability to pursue and implement technological innovations. As Ünlükaplan (2009) has stated, the main driving forces of high development performance are technology and innovation. Innovation is the key to economic growth, increased employment and quality of life (Satı&Işık, 2011). With the emphasis on the same point, Schacht (2000); mentions the importance of technological developments and on the growth of the US. Monitoring and supporting these developments on a government basis is also the substantial factor of the growth. According to the Global Innovation Index of 2017 published 10th in cooperation with INSEAD (The Business School for the World) and WIPO (World Intellectual Property Organization), Turkey became 43rd innovative country among 127 countries in 2017. It was 42nd in 2016 and 58th in 2015 in the same ranking. Table 1 lists the top 10 countries in the Global Innovation Index for the years 2015-2017 and the ranking and scores of the 4 countries ahead of Turkey. According to the table, Switzerland, Sweden and the Netherlands are in the first 3 in the order of 2017. Turkey lags behind Hungary (39), Lithuania (40), Croatia (41) and Romania (42) with the score of 38.09 (Okay, 2017). In addition Turkey is among the "modest innovators" in the EU's 2015 Innovation Index (European Commission, 2015) or a "country in the period of transition from the efficiency-driven economies to innovation-driven economies" if listed on GNP basis (Gökçe, 2016).

Tablo 1. The Global Innovation Index

	2015		2016		2017	
Country/Economy	Rank	Score (0–100)	Rank	Score (0–100)	Rank	Score (0–100)
Switzerland	1	63,8	1	66.28	1	67,69
Sweden	3	62,40	2	63.57	2	63,82
United Kingdom	2	62,42	3	61.93	5	60,89
United States of America	5	60,10	4	61.40	4	61,4
Finland	6	59,97	5	59.90	8	58,49
Singapore	7	59,36	6	59.16	7	58,69
Ireland	8	59,13	7	59.03	10	58,13
Denmark	10	57,7	8	58.45	6	58,70
Netherlands	4	59,97	9	58.29	3	63,36
Germany	12	57,05	10	57.94	9	58,39
Luxembourg	9	59,2	12	57,11	12	56,40
Thailand	55	38,10	52	36,51	51	37,57
Macedonia	56	38,03	58	35,4	61	35,43
Mexican	57	38,03	61	34,56	58	35,79
Bulgaria	39	45,16	38	41.42	36	42,84
Poland	46	40,16	39	40.22	38	41,99
Greece	45	40,28	40	39.75	44	38,85
United Arab Emirates	47	40,06	41	39.35	35	43,24
Hungary	35	43	33	41,76	39	41,74
Lithuanian	38	42,26	36	44,71	40	41,17
Croatia	40	41,7	47	38,29	41	39,8
Romania	54	38,2	48	37,9	42	39,16
Turkey	58	37,81	42	39.03	43	38,09

Source: Okay, 2017

Technological improvements that are on the basis of innovation, which means the renewal of science and technology in a way to provide economic and social benefits (Bayraç, 2003), transform the society from static to dynamic (Bal, 2013). This leads to positive results like social welfare, increasing living standards, ensuring sustainable economic growth, increasing employment, efficient use of resources, uncovering new sources of raw materials, increasing exports, increasing patent numbers, contributing to the regional development, increasing entrepreneurship and the decreasing external dependency (Uzkurt, 2010). The innovation ability of a country depends on multiple actors and their equivalent achievements (Koç&Mente, 2007). The strength of all these actors increases the competitiveness of the countries. Today, national economies have become increasingly vital elements to be based on the innovation paradigm in terms of global competitiveness levels. The idea that innovation is based on competitiveness has been put forward in Schumpeter's work, which for the first time defined market dynamics as the creative demolition process for the first time (Ünlükaplan, 2009). Today, the desire to increase the quality of life and the expectation of continuity in the demand for productivity is the driving force of the concept of innovation. The concept of innovation consists of science, technology and design components in a way that the whole world has agreed upon. This points to the influence of R&D on innovation. It is also observed that developed countries are able to secure a strong sustainable economy with their investment levels (share of GNP) and stability (process) in innovation, thus contributing to the goal of creating a high quality of life (Gürsu, 2014). However, according to the IMF (2016) reports, 5.9 billion people, which is 85% of the world population today, are living in the poor-developing countries. The countries that have shared the top 10 rankings in the competitive power of the World Economic Forum 2016-2017 Global Competitiveness Report are as follows: Switzerland, Singapore, USA, Netherlands, Germany, Sweden, United Kingdom, Japan, Hong Kong, Finland. Turkey drops four places to 55th among from 51 above 138 countries in 2016 from the previous year (note that

the data were collected before the attempted coup in July 2016). But it should be remembered that this ranking was 43 in 2012 (Schwab, 2016). According to the report, Turkey's ranking in the main component of "Innovation" is 69 in 2017. This ranking was 56 in 2014, 60 in 2015, and 71 in 2016. Even if the list shows that Turkey has shown a falling tendency in innovation between 2014-2016 and has risen again in 2017, the ranking is still below 2014. According to Schwab (2016), "to create a more dynamic business environment, domestic competition needs to be improved and investments are needed to develop a sound innovation ecosystem to help the country move up the global value chain. This includes improving business sophistication and fostering companies' innovation by boosting workforce qualifications—Reforms are also needed to make public institutions more efficient and transparent." If the subject is to be evaluated in terms of R&D and innovation relationship: R&D expenditures in the world are increasing every year. Total R&D expenditure in the world in 2016 is around $ 1.7 trillion. The spending average of 15 countries with the highest R&D in the world is 3%. USA, Germany and France, which are among the top 10 economies of the world, set their 2020 R&D investment targets at 3%. While the target of Finland and Japan is 4% for 2020, China has set the target of 2.5%. Also, the EU has set an average R&D investment target of 3% for 2020. From the viewpoint of the distribution over the earth; it is seen that 85% of all R&D investments are made on the axis of USA, Europe and Japan. According to the EU report "Top Innovators and R&D Spenders of the world" (PwC, 2016): 35% of companies making R&D investments are US companies, 28% are European Union companies, 22% are Japanese companies and 15% are the others. There are 18 companies in the US, 15 companies in the EU and 13 companies in Japan, that make the most R&D investment all over the world, The sectors in which R&D is most intensively are; Medicine-biotechnology, technology, hardware and equipment, automotive, software and computer services, electrical and electronic equipment and the chemical. Medicine, ICT and automotive constitute more than half of R&D investments worldwide. Turkey has set a target of 3% R&D expenditure annually until 2023. Turkey, which aims to become one of the world's top 10 economies in 2023, needs to increase its R & D investments in order to achieve this goal. It is seen that the resources allocated to R&D in Turkey have increased in recent years. Despite this increase, the ratio of R&D spending to GDP (1.06%) has not yet reached the desired point (Taşkın, 2017On the other hand, according to TUİK (2016), Gross Domestic R&D expenditure is calculated as $ 5.752 billion in 2015, increasing by 17.1% over the previous year.

Table 2: Top 20 R&D Spenders of the world

2016 Rank	2015 Rank	Company	Geography	Industry	R&D Spend ($Bn)*
1	1	Volkswagen	Germany	Automotive	13.2
2	2	Samsung	S.Korea	Computing and electronics	12.7
3	7	Amazon	US	Software and Internet	12.5
4	6	Alphabet	US	Software and internet	12.3
5	3	Intel Co	US	Computing and electronics	12.1
6	4	Microsoft	US	Software and internet	12
7	5	Roche	Switzerland	Healthcare	10
8	9	Novartis	Switzerland	Healthcare	9.5
9	10	Johnson&Johnson	US	Healthcare	9
10	8	Toyota	Japan	Automotive	8.8
11	18	Apple	US	Computing and electronics	8.1
12	11	Pfizer	US	Healthcare	7.7
13	13	General Motors	US	Automotive	7.5
14	14	Merck	US	Healthcare	6.7
15	15	Ford	US	Automotive	6.7
16	12	Daimler	Germany	Automotive	6.6
17	17	Cisco	US	Computing and electronics	6.2
18	20	AstraZeneca	Britain	Healthcare	6
19	32	Bristol-Myers Squibb	US	Healthcare	5.9
20	22	Oracle	US	Software and internet	5.8

* R&D spend data is based on the most recent full-year figures reported prior to July 1st.
Source: Pricewaterhouse Coopers (PwC), 2016

Table 2 shows the ranking of AR-GE expenditures by multinational companies that have been

published by PwC (2016). Volkswagen is the 1st in 2016. Making a comparison; the annual R&D expenditure of the company, which is $ 13.2 billion per year, is 2.3 times that of Turkey's total R&D expenditure per year. It is evident that R&D expenditure of Turkey as a nation can not reach R&D expenditure of a multinational. Given the benefits of innovation to society and the economy, it is imperative to address the concept in terms of poor-developing countries, including Turkey. The most important features that differentiate developed countries from developing countries are 'technological development levels' and 'technological efficiency skills' (Gürsu, 2014). Innovation would be an important opportunity and impetus in the development of poor countries. Moreover, the poor countries are mega-markets with micro-consumers (Govindarajan & Trimble, 2013). This is a striking phenomenon for the rich country's multinational companies which are faced with danger of market saturation. They have to develop the policy of expansion. For example, even China alone, which has 1.3 billion consumers with high growth rate and breadth, is an extremely worthwhile market (Huang & Anderson, 2013). 'Reverse innovation', which is a special category of innovation (Govindarajan & Trimble, 2012) as a very new phenomenon, precisely emerges at this point.

Table 3: Mainstream theories and reverse innovation

Topic	*Mainstream view*	*Observed aspects of reverse innovation that do not fit with mainstream*
Innovation	• Innovations trickle down from rich to poor countries • Innovations begin with lead users and spread to the others	• Innovations may also occur in poor countries and 'trickle up' to rich ones • Reverse innovations may begin with laggards rather than lead users
The Process of Internationalization	• Multinationals originate in rich countries and spread globally, including to poor countries, based on proprietary technologies/brands	• Multinationals also originate in EM; and spread globally, including to developed countries, leveraging home-based innovations
Strategy and Management of Multinational Enterprises in Developed Countries	• DCME, develop global product platforms in triad markets and adapt them for EM; • DCME give global product mandates to subsidiaries in other triad markets	• DCME develop new product platforms in EM; for emerging markets; • DCME give global mandates for some products to subsidiaries in EM;
Foreign Direct Investment Spillovers	• Local firms in emerging markets; capture spillovers from DCME that invest in EM	• DCME capture spillovers from local firms when they invest in EM (i.e., learning is bidirectional)

Source: Govindarajan & Ramammurti, 2011 (DCME: Developed-country multinational entreprises EM: Emerging markets)

Particularly noteworthy is the fact that "innovation" is not contrary to the basic theories, but instead introduces a new action framework based on the same theories. Table 3 presents threats and opportunities in terms of mainstream theories in 4 key areas which are reverse innovation, the process of internationalization of innovation, strategy and management of multinational enterprises in developed countries and diffusion of foreign direct investment spillovers. The 2nd column lists the mainstream views and the 3rd column lists the observed aspects of reverse innovation that do not fit with mainstream for each topic listed in the 1st column (Gümüştekin&Büyük, 2017). As mentioned above, the dynamics of "change", whose innovation is obliged, have begun to require the change of innovation itself. The development of the innovation process has begun to create a kind of saturation in the transfer

of technology, process and product and innovation to the developing countries from the developed countries, and it has started to follow the opposite course as it is found in many examples in the world. In other words, reverse innovation is to innovate for low-income consumers in developing countries and then distribute these products to the whole world that everyone can buy (Capital, 2013). Nowadays innovation is displaying a new -and contrary- situation that is starting to show a leap from developed and poor countries to developed countries which is getting much more interesting for researchers (Gümüştekin&Büyük, 2017). Multinationals are on the path of setting up R&D centers by spending much lower money in emerging markets instead of their own by force of the reverse innovation. These centers can focus on the top ten emerging markets which are Brazil, China, Indonesia, South Africa, India, Mexico, Nigeria, Russia, Turkey and Vietnam, that account for more than 60% of the GDP of the world population and countries (Govindarajan & Trimble, 2013). According to the Turkish Patent Institute Statistics (2016), in Turkey, a total of 16,778 patent applications were made in 2016, of which 6.445 were native and 10.333 foreign. The increased rate of total patent applications with 20.20% increase compared to the previous year is 16.93% in domestic firms and 22.34% in foreign firms. In total, Germany was ranked 1st with 2,244 applicants, the USA ranked 2nd with 1,538 applications, Italy ranked 3rd with 704 applicants. These figures reveal that foreign capital has already discovered the potential in Turkey and has begun realizing some of its R&D's within the borders of Turkey. For example, IBM invested $ 1 million and opened the 41st Innovation Center in Turkey in 2008. The firm has 12 research centers and 3000 research staff spread over the world by 2017 (IBM, 2017). IBM ranks 1st, among the top 10 companies (U.S. Patent Trends&Insights, 2016) with the highest number of patents per year in the US with more than 8 thousand patents (nearly 22 per day) acquired in 2016. While Samsung followed IBM with the 5.518 patent, 3th. is Canon (with 3.665 patent), 4th. is Qualcomm (with 2.897 patent), 5th. is Google (with 2.835 patent), 6.th is LG (with 2.428 patent), 7th. is Microsoft (with 2.398 patent), 8th. is Taiwan Semiconductor Manufacturing Co. (with 2.288 patents), 9th. is Intel (with 2.784 patents) and 10th. is Sony (with 2.181 patents).

The position of innovation and its expansion in the global economy has begun to change with the rise of emerging economies such as China and India. Poor, emerging markets no longer take innovations from developed countries, but from time to time they contribute to the rest of the world in terms of innovation, including developed countries (Govindarajan & Ramammurti, 2011). Examples of recent innovations that are well known in emerging markets include Tata Nano, Grameen Bank (microfinance), General Electric's ultrasound, Embraer's regional jets, the famous Chinese brand BYD's electric car, Bharti Airtel's the cheapest wireless phone and Nokia's cheap mobile phones. A few of these innovations occur in poor countries and 'trickle up' to rich ones. However, innovation in poor countries seems to be much deeper and wider than these examples, and many of them will be international in the future. Innovations in emerging economies do not tend to be technological inventions as in developed countries. They even combine existing knowledge and technology with unusual and innovative combinations in solving local problems and in using new process and business models. Companies that lead this innovation effort can also be local or foreign multinationals, operating in emerging markets (Gümüştekin&Büyük, 2017). In addition the use of talent, technology, and ideas from many different regions of the world in developing country-based innovations is acceptable in today's integrated world. For example, GE's ultra-low-cost ultrasound and ECG machines were initially managed for use in China and India, but with the funding of local and foreign affiliates and leadership of development teams in these countries. The invention of Tata Nano was the same (Govindarajan & Ramammurti, 2011). Because poorly funded rural clinics couldn't afford the company's sophisticated ultrasound machines, GE has not been able to sell medical equipment in China and India. So it has entered these markets by developing portable ultrasound out of a laptop equipped with special peripherals and software. It not only became a hit in China and India but jump-started growth in the developed world by pioneering applications for situations where portability is critical, such as at accident sites. The same innovations have trickle up again in the US market today, and many places like emergency services, small clinics, ambulances have begun to be used as alternative medical devices (Immelt et. al., 2009). As Western businesses leverage their R&D departments around the world, multi-centered innovation is emerging and non-Western businesses become new centers of power for many new innovations, from telecommunications to computers. The innovation route is now reversed in every aspect, nowadays there is a flow from east to west and from customer to business (Rakıcı 2014).

Table 3: Reverse innovation cases in Turkey

Check up by mobile phone	A Software has been developed that will enable medical check-up using a drop of blood via mobile phone. The software that scans a drop of blood on a special paper, performs the diagnosis according to the color change. Developed within the scope of the project called "BİORGB" which was carried out at İzmir Institute of Technology, the software is a platform that can take the place of the tests imported from abroad by TC Ministry of Health and perform diagnosis and screening in a shorter period of time. The software can diagnose influenza, Hepatitis B-C as well as HIV virus and cancer.
Artificial skin from stem cell	Dr. Ercument Ovalı has produced artificial skin from blood and stem cell. The invention awarded the Best Experimental Paper award from the American Society of Plastic Surgeons. The artificial skin that is produced will be used in acute burns to repair the loss of skin after surgical operation, as well as in patients who have lost both functional and cosmetic images.
Artificial blood	Artificial blood production is carried out in laboratory conditions. The hemoglobin-based artificial blood produced within the scope of the Multidisciplinary Research Project presented to Tübitak in cooperation with Osmangazi University and Anadolu University would be donated to anyone without considering the blood group and used especially in ambulances. Through this invention, it is planned to prevent diseases transmitted via blood.
Wearable sensor technology	Dr. Özgür Atalay and Dr. Aslı Atalay have developed wearable sensor technology made of silicone and fabric, compatible with body structure. It'is developed for paralyzed patients who are unable to walk, will be designed as soft, wearable outer skeletons.

Source: Berk, 2017; Uğraş, 2017; AA, 2016; AA, 2017

The world's largest international companies have begun to shift R&D departments to the developing world. While globalization is thought to be governed by the western world, today the companies which are not western such as ArcelorMittal (Steel-India), BYD (Battery-China), Cemex (Cement-Mexico), Jet Aircraft (Aerospace Industry-Brazil), Infosys (IT-India) are leading the world in different sectors and also leads to a change in this view (Gümüştekin&Büyük, 2017). It is precisely at this point that reverse innovation does not only change the flow direction of innovation, but also the needs of consumers in poor and developing countries' markets should also be taken into consideration. Today's consumers prefer technological products at the highest level when determining their needs or looking for their solutions. This is not only true for consumers living in poor, developing countries, also for consumers living in developed countries. The only difference is that there are fewer people in rich countries who spend a lot of money, while in poor and developing countries there are many people who spend a lot of money (Govindarajan and Trimble, 2013). In addition, the fact that there are also poor people in rich countries should also be considered. This necessitates a redesign of high-priced products through innovative processes in terms of price, ease of use, portability, maintenance, etc. for consumers in the remaining 60% of the world (Gümüştekin&Büyük, 2017). Some of the most common examples of Turkish reverse innovations today are listed in Table 4, and they are often in the health field, as in the rest of the world.

Reverse innovation can also be defined as: the innovation produced in low-income countries being sold in high-income countries. Based on the examples in the world: the role of innovation in the economy and development of South Korea is quite impressive. It is the 5th country in the world which means the total number of patents and has 5% of all patents. S. Korea, which had been lower from Turkey for income and expenditure per capita until the 1980s, totally reversed this situation; in addition to significant growth and development, it has also achieved rapid technological development (Gümüştekin&Büyük, 2017). It succeeded because of giving importance to the technology and R&D; putting innovation, education and development forefront. The country has taken major steps to be able to compete with the developed countries by maintaining various change processes. The most important

factor of this transformation process was the development of innovation and its transformation into the policy (Oğuztürk, 2011). S.Korea has started to transfer the technology it has been producing to developed countries and set a good example for reverse innovation. Ireland created a common action plan in 1969 on innovation. Ireland Industrial Development Agency (IDA) identified the country as a base, specified sectors which could compete in global markets, and created a business alliance between multinational businesses, universities, and research centers by establishing 11 offices in different regions of Ireland, 3 in Europe, 5 in Asia Pacific, and 5 in the the USA (Elçi, 2006). China has taken similar steps to attract foreign direct investment from multinational corporations with similar financial policy instruments and incentives. Mechanisms have been developed to encourage investment in priority sectors and regions, reflecting significant tax advantages for multinational corporations in the country. Income tax starts 2 years later for the multinational companies investing in China. They get a %50 discount for the next 3 years. In high-tech companies, this period is six years. In 2004, Motorola established 15 local and global R&D centers in the country. Likewise, IBM, Motorola, Intel, AstraZeneca, Eli Lilly, GE, GM, Microsoft, Adobe have R&D centers in India. (Erdil et all., 2011).

CONCLUSION

Turkey has no option but to gain innovation skills effectively to be able to progress competitiveness. The country has to develop effective and accurate policies and be competent in technology. Given the success of individual innovative activities, it appears that Turkey has the ability of reverse innovation and 'trickle up' to the emerging markets. There is a need for better analysis of examples of public innovation activities around the world in Turkey. The existing strategy of public innovation has to be prioritized. The transition of production economy has to be through the instrument of technology, innovation, and science. Future and competitive advantage plans of sustainable development have to include reverse innovation. To be able to provide this, participatory decision-making mechanism, university-industry collaborations, network structures, techno-parks and similar structures have to be constituted that set in motion national, regional and local dynamics as in the case of Ireland. As a developing country, Turkey's potential for reverse innovation has to be determined as soon as possible. Therefore Turkish academicians should conduct new studies about reverse innovation. It is suggested to add new studies to the literature by supporting the existing theoretical infrastructure with empirical data.

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