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Innovation Model Generation Based on Triple Helix Collaboration: Case of TURKEY

by

İkbal Sinemden OYLUMLU

Master of Business Administration

Department of Technology and Innovation Management

Istanbul, 2015

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by

İkbal Sinemden Aylıyılı

Approved by:

Dr. Özlem AKALIN
(Supervisor)

Assist. Prof. Dr. Fahrettin Akkaya

Assist. Prof. Özlem Kundaş

Date of Approval by the Administrative Council of the Institute 16/06/2015

ABSTRACT

Today, the socio-economic developments of the countries are named after *information age*, and it is not possible to stay out of global developments. Innovation has an important place in today's economy. There has been a transition from giant factories to offices, working conditions' ways have changed together with the ICT, and the women's contributions to economy have considerably increased. It has been uttered that being bindingly creative, innovative, productive and sensitive to environment has been the reality of the century. It has been determined that economy can gain force through the natural resources, powerful human resources, creativeness, technology, sustainable innovation system and network structures. Carrying out innovation can only be possible through confirming to the abovementioned system.

Models and developments belonging to the innovation ecosystem taking place in the literature are historically analyzed for Turkish models. The existed government explicated Turkey's objective as *"being one of the first five economies of the world"*. On the route to attain this objective, the economic developments were chronologically presented in the literature part in order to be able to scrutinize Turkey's conditions of competing in the global market. As innovation strategies have an important place in the world market, the innovation models and university-industry-state cooperation are examined. Successful countries, which have established their innovation strategies beforehand, determined in the analysis and discussion chapters have been compared and contrasted with Turkey on the basis of the data collected from the GII, OECD, and WIPO and the results were thoroughly assessed. In line with the results of these analyses, Turkey's situation was determined and the areas in which Turkey would improve were detected, as well. Depending on the Triple Helix Model, a study proposing a model for Turkey was explicated on the basis of the literature, analysis and discussion chapter of the thesis. Turkey has the features that will carry the country to success such as population properties, geopolitical structure, being on the routes of commerce and trade and having vast amount of variable resources, if the resources are managed to be used in a systematic way. Turkey has the capacity for using the resources

owned by the country systematically, monitoring the data through assessment and taking steps forward via the lessons to be taken from failures.

Key Words: Innovation, Triple Helix Collaboration, R&D, Technology, Innovation Models of Turkey

ÖZET

Ülkelerin sosyo-ekonomik gelişmeleri *enformasyon çağı* olarak adlandırılan günümüzde, küresel gelişmelerin dışanda kalabilmek mümkün olamamaktadır. İnovasyon günümüz ekonomisine önemli bir yere sahiptir. Artık dev fabrikalardan ofislere geçilmiş, BIT ile birlikte çalışma şekilleri değişmiş, kadınların ülke ekonomisine katkısının artmış olduğu görülmektedir. Bu dönemde yaratıcı, yenilikçi, üretken ve çevreye duyarlı olmak zorunluluğu yüzyılın gerçeği halini aldığı ifade edilmektedir. Ekonominin doğal kaynaklar, güçlü insan kaynakları, yaratıcılık ve teknoloji, sürdürülebilir yenilik sistemleri ve ağ yapılarıyla güç kazandığı tespit edilmektedir. İnovasyon yapılabilmesi yukarıda belirtilen yeni sisteme uyumlanmakla mümkün olmaktadır.

Türkiye model önerisi için literatürde yer alan modeller ve inovasyon ekosistemine ait gelişmeler tarihsel olarak incelenmiştir. Türkiye'nin hedefini son hükümet; "*dünyanın ilk beş ekonomisinden biri olmak*" olarak ifade etmiştir. Bu hedefe giderken Türkiye'nin küresel Pazar içinde rekabet edebilme koşullarının incelenebilmesi için ekonomik gelişmeler kronolojik olarak literatürde yer almıştır. Yenilik stratejileri dünya pazarında önemli bir yer teşkil etmekte olduğu için inovasyon modelleri ile üniversite-sanayi-devlet işbirlikleri incelenmiştir. Analiz ve tartışma bölümünde daha önce inovasyon stratejilerini oluşturan ve başarılı olan ülkeler ile Türkiye'nin karşılaştırması GII, OECD ve WIPO raporlarından alınan verilerle yapılmış ve elde edilen sonuçlar değerlendirilmiştir. Bu verilerin sonuçları doğrultusunda Türkiye durum tespiti yapılarak, ülkenin gelişme gösterebileceği alanlar tespit edilmiştir. Üçlü Sarmal Modele dayalı olarak Türkiye model önerisi çalışması literatür ve analiz ile tartışma bölümündeki verilere dayalı olarak yapılmıştır. Türkiye'nin güçlü olduğu alanlarla desteklenmesi gereken alanlar belirtilerek oluşturulacak modellemeyle ilerleme sağlanabilir. Sahip olduğu nufüs özellikleri, jeo-politik ve kültürel yapısı, ticaret yolları üzerinde bulunması ve kaynaklarının çeşitliğini etkin olarak kullanması Türkiye'nin hedeflerine ulaşmasında avantaj sağlayabilecek özellikleridir.

Key Words: Innovation, Triple Helix Collaboration, R&D,Technology, Innovation Models of Turkey

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ACKNOWLEDGMENTS

Firstly, I would like to thank my supervisor, Özlem AKALIN, who has provided me with insightful and invaluable feedback and guidance. I would like to thank B. Aykut ARIKAN and Özlem KUNDAY for their patience, proof-reading and constructive critics.

Secondly, I would like to thank Ayhan KEÇECİOĞLU has provided me with insightful and invaluable feedback in writing this thesis. Furthermore, I would like to thank Yeditepe University Knowledge Center all workers, and of course R. Handan ÇELİK offers me all knowledge materials. Also, I would like to thank my friend M. Serdar BEYAZ that is draw index map. They have my deepest gratitude for making their valuable time available.

Finally, I want to thank my sister and mother for their understanding and support throughout the intensive writing process.

The responsibility for inaccuracies or shortcomings in this thesis is completely mine.

LIST OF ABBREVIATIONS

EU: European Union

GDP: Gross Domestic Product

GERD: Gross Domestic Expenditure on Research and Development

GII: Global Innovation Index

ICT: Information and Communication Technology

IP: Intellectual Property Rights

KOSGEB: Small and Medium Enterprises Development Organisation

NSF: National Science Foundation

OECD: Organisation for Economic Co-operation and Development

R&D: Research and Development

SANTEZ: Industrial Theses Support Program

SME: Small and Medium Enterprise

TAS: Turkish Academy Sciences

TEA: Turkish Exporters Assembly

TEKMER: Tecnology Development Centers

TPI: Turkish Patent Institute

TSE: Turkish Standart Institute

TTO: Technology Transfer Office

TUBA: Turkish Academy of Science

TÜBİTAK: The Scientific and Technological Research Council of Turkey

TÜİK: Turkish Statistical Institute

USA: United States of America

WIPO: World Intellectual Property Rights Office

1. INTRODUCTION

Knowledge economy and globalization to be effective given the new market economy, the importance of university-industry-government cooperation emerges as the inevitable innovation able to do. In these days, universities, industry and governmental levels should contribute to the national economy by creating value by working for social benefits. Located within the industry is the locomotive force of the economy to support firms' R & D spending made possible by university-government collaboration, however, the University contributes to the development of the industry - can develop within the framework of industrial collaborations.

Mahmut Kiper as pointed out; "Looking at this situation, the National Innovation System, the Scientific Knowledge Production New "Mode 2" Approach and University-Industry Collaboration "Triple Helix Model" is the change in the observed relationship networks and cooperation structures in this area." (Kiper, 2010)

In the first part, economic development processes in Turkey and around the world will be scrutinized under the subject matters of agricultural society, and agricultural economics, industrial society and industrial economy, information society and information economy. In addition, the new theoretical economic approaches created by the economic leaps and crises are explained chronologically in this study.

The differences between the U.S.A.'s fundamental historical development processes of its economic system and the transformation processes of agricultural society/economy, industrial society/economy and information society/economy in Turkey are examined. Besides, the development of R&D studies in Turkey and the world are examined with the same approach in this section of the study.

Universities, was made through the stage of basic research and education institutions as they appear today, "Third Generation" evolution has accelerated as a result of coming to a condition called. According to Wissema, "Basic research can only be sustained if the government and industry working in collaboration. The university will remain faithful to its mission: To generate new knowledge and training, information to make part of the production process. This mission should be carried out in the present context. It is useful to perform, "he says. Nevertheless Wissema, have embraced this mission, Stanford university leaders have emphasized that schools like MIT. As can be seen from the above, universities also undertake the task of creating value on education and innovation taking place in the national economy by contributing to the industry today, as well as their main function.

In the second part, the foundation and transformations the universities have gone through up until this period will be scrutinized chronologically in three periods in this section. The changes in today's education paradigms of universities, and, besides the universities main functions, the reasons of their assuming the mission of creating values as regards to education-training and innovation by involving in the country's economy through contributing to the industry will be scrutinized; the reflection of economic and social transformations on the strategies and education systems of universities are touched upon in this section, as well. Briefly, the main focus of this study will be the universities, their historical development, the stages they have gone through to reach today's conditions, their strategies, and the way the collaboration between universities and industry is constructed.

In the third part, the history of the cooperation between university and industry, and the duties and responsibilities of the universities, industry and state within this model will be scrutinized on the basis of the "triple helix model." Along with that, the interdependent expectations of universities and the industry, the ways they contribute to each other are also analysed; and the tools utilized for the robust continuation of these relations will be discovered. Within this

context, the ways the university models have developed in the world, the processes they have gone through, industrial cooperation they have had, and the duties of the state will be investigated.

The concept of innovation will be defined on the basis of the Triple Helix Collaboration in the university-industry-state cooperation and the relevant model's connection with the innovation ecosystem will be explored in the fourth section. For this reason, the concept of innovation and its variances, along with the elements constituting the innovation ecosystem will be expressed, and the impact of the "Triple Helix Cooperation" on the R&D and entrepreneurship will be scrutinized in the fourth section. In addition, the subject of Intellectual Property Rights will be examined in this section as well.

In the analysis section, the Global Innovation Index 2014 – which is a secondary data –, GII (Global Innovation Index) 2011.2012.2013 data, and relevant information from the OECD reports will be used for annual comparison. In addition to the GII data, data belonging to the Turkish Statistical Institute will be benefited from to study Turkey. A comparison and contrast will be carried out for U.S.A, and Germany, with Turkey - the countries that are among the first five in the Global Innovation Index 2014 indicators index - and South Korea and China with Turkey in terms of their resemblances R&D structure. The innovation structures and models of the abovementioned countries will be scrutinized, and on the basis of the results acquired from these evaluations; Turkey will be assessed and Turkey's analysis will be done according to the GII.

The last government explicated Turkey's objective as *"being one of the first five economies of the world"*. On the route to attain this objective, the economic developments were chronologically presented in the literature part in order to be able to scrutinize Turkey's conditions of competing in the global market. As innovation strategies have an important place in the world market, the innovation models and university-industry-state cooperation are

examined. Turkey's case study, based on Triple Helix Model of R&D approach in the context of “What should be the model of innovation to compete in the global market in Turkey?" The answer to this question by calling the thesis will be terminated.

2. LITERATURE REVIEW

2.1 The Historical Transformation of Economic System

Economic development processes in Turkey and around the world will be scrutinized under the subject matters of agricultural society, and agricultural economics, industrial society and industrial economy, information society and information society. In addition, the new theoretical economic approaches created by the economic leaps and crises are explained chronologically in this study.

The differences between the U.S.A.'s fundamental historical development processes of its economic system and the transformation processes of agricultural society/economy, industrial society/economy and information society/economy in Turkey are examined. Besides, the development of R&D studies in Turkey and the world are examined with the same approach in this section of the study.

2.1.1 Review of the Industry from Economic Approach

It has been observed that the general evaluations carried out in the economic development process are classified as agricultural society/economy, industrial society/economy and information society/economy. It has also been determined that transitions take place in these classifications. This study is shaped on the basis of the relevant approach.

2.1.1.1 *Agricultural society and agricultural economy*

Economic activities and the existence of economic system based on vital needs are observed in the pre-agricultural primitive societies according to Maslow's fundamental needs theory. Within this regard, there was a social order based on tribe life and sharing, in which people would meet their sheltering and nutrition needs by hunting and gathering. The technology if this

period, on the other hand, consisted of primitive elements, such as protective weapons, food, clothing and sheltering.

With the increase in the number of the society population; hunting and gathering started to be inefficient and following that, the process of transition to agricultural society was commenced together with cultivation, and domestication of animals. The technology depended upon developing tools that would facilitate cultivation.

Toffler named the agricultural society as "First Wave." The pre-agricultural society that dealt with hunting, gathering and fishery was seen as primitive by the "First Wave" society. Yet, there are certain similarities between the agricultural society and pre-agricultural society. Toffler states that there are similarities between the two societies in terms of the properties of the living places, earthbound economy, culture and family structures (Toffler, 2008). Furthermore, pre-agricultural and agricultural societies show similarities as regards to the division of labour and class differentiation which is similar to the cast system, having sharp contrasts (Toffler, 2008).

Exceptionally, there were "centripetal and agricultural kingdoms which had grown on the basis of large irrigation networks and dealt with overseas commerce" in that period (Toffler, 2008). The kingdoms that showed central growth had a commercial system differently from the other agricultural societies. Besides that, it is a known fact that facilities like factories, where serial production was carried out – although it was small-scale – were existent in the ancient Greece and Rome. Although the barter system continued in commerce, it has been uttered that the usage superiority of money started to be reflected on the commercial life within this period.

This period, which continued between the years of 1650-1750, ended with the usage of tractors in fields, establishment of large companies, change of the tools utilized in daily life, and formation of a systematic order in the commercial life. This became the commencement of the transition to the industrial society, which is also called as "Second Wave."

2.1.1.2 *Industrial society and industrial economy*

The weighted opinion in the transition from industrial society to industrial economy is that "The discovery of the steam engine by James Watt in 1675 and its use as energy led to a range of technological development." (Erkan, 1994).

The industrial revolution does not only bring technological innovation. Together with the impact of these innovations, certain changes in science, politics and social fields emerged. The book called as 'Wealth of Nations' written by Adam Smith in 1776 constitutes the turning point of the economics, as a science; and the French Revolution of 1789 constitutes the turning point of the industrial society within the scope of the political developments (Erkan, 1996).

2.1.1.2.1 **First period: classical period economy**

The first period of industrialization is referred as "Classical Period" in numerous sources. The administration theories of the concerning period are explicated in three main movements by Alparslan and Kutanis (2007) on the basis of Taylor, Fayol, and Marx's opinions.

It is scientifically determined in Taylor's approach that the relations of interest between the administration and the employees are practically the same, as propounded by the statement of "employer's satisfaction, employee's satisfaction." Taylor's approach was based on "science, harmony, cooperation, maximum level of production and employees' reaching to prosperity and efficiency at the utmost level in the early 1900s" according to the same source (Alparslan and Kutanis, 2007).

In other words, the relations between the employers and employees shall be harmonious, systematic, productive, and based on mutual interests. Furthermore, increase in the level of efficiency comes out as a factor incrementing the prosperity level for the employers and employees according to this approach.

Fayol, who has conducted studies on organizational design and administration, threw light on his approach to organizations as the following: "All the processes necessitated by the industry

are grouped in four fields as technical, commercial, security, and administration. Planning, organization, control, coordination and control are under the administration's responsibility according to Fayol. The administration principles, on the other hand, are; division of labour, authority, discipline, control unity, preference of general outcomes to private outcomes, payment of the work cost, centrality, hierarchical chain, order, justice, stability in the officers, idea of initiative, informing the officials." Weber uttered that, "There is no other way than the bureaucratization of the modern world and the major source of this method is technical information" (Alparslan and Kutanis, 2007).

2.1.1.2.2 **Second period: Neo-classical period economy**

It is propounded that the socio-economic structure of the world entered a consolidation term in the second period of the industrial society. The specialists who defended the neoclassical approach tried to comprehend human behaviour by starting to benefit from the social sciences (anthropology, sociology, and psychology, etc.) in that period, which was called the period after 1873. "The business world had given importance to those studies in order to support the management," (Ponnally et al., 1992).

Within the framework of the development economy approach, especially the qualitative transformation rather than quantitative transformation was focused on, and "the general advancement in the life standards and the construction of high level of welfare were frequently emphasized" (Reyhan and Mahmut, 2011).

Reyhan and Mahmut stated in reference to Porter's micro economics approach that "There is a need for a long-term construction process of certain interdependent microeconomic opportunities-abilities and initiatives to support the more specialized forms of competition (Reyhan and Mahmut, 2011).

Griffin asserts that the first paradigm breaking was realized through the behaviours of the individuals, group works and processes; Harvey, on the other hand, stresses that informal

interactions is important as much as formal interaction in bureaucracy, and puts emphasis on the limits of maximum rationalism in terms of organization (Harvey, 1975).

2.1.1.2.3 **Third period: Welfare society/consumption economy period**

The last period of the industrialism is identified as "welfare" or "consumption society". "The crises that have been gone through in this last period started with the impact of the 1967 economic stagnation, and continued with the "insurrection and reaction" started socially by the youth in 1968. In this study, which was started one year before the 1973 Petrol crisis, it is emphasized that the raw material sources of the world are limited and there is a risk of depletion. In addition, environmental pollution was also underlined. The impact of the petrol crisis, on the other hand, is stated to start the process of technological development.

Besides these, the "Contingency Approach", which was based on the researches in the last period of the industrial society, emerged. According to this approach, each and every organization's environmental and technological situations are different from each other (Toptop et al., 1993). This relevant approach accepts the preceding theories, yet follows a different method than those theories, believing that other theories or approaches can be utilized as solutions for the organizational issues and risks that are encountered within the organization. The fact that organizations exist in a complex environment in the new period and that the field of activity exceeds the boundaries and encompasses the world oriented experts to studies on the basis of research. Furthermore, it is a known fact that "legal, political variables and external factors constitute risks and opportunities for the organizations" (Phatak, 1984). As a result of this, the organization management or administrative body must make decisions taking the changes that take/may take place in the environmental factors into consideration (Alparslan and Kutanis, 2007).

Certain researchers divided this period of industry into three as 1st Generation, 2nd Generation, and 3rd Generation within the framework of the development concept.

There are two views present in the period, which is defined as the 1st Generation above. The 1st view was defined in reference to Toye on the basis of "the rescue and welfare activities", and the concept of underdevelopment was scrutinized in this view on the basis of developed countries' point of views by looking at the internal dynamics of the underdeveloped countries for the real problem. The second view, on the contrary, is based upon the fact that the problem arises from the relational imbalance between the two blocks from the perspective of underdeveloped countries. The origin of the problem is thought to be the continuous relationship between the developed and underdeveloped countries, which is identified as dependency resulting from production and structural features. (Doğan, 2011).

Başkaya (2011) states that "the tangible changes seen in social life should be involved in the Welfare Society, as well, and this concept cannot be defined only in economic sense." In other words, "not only the material welfare such as nutrition, sheltering, health, education, equality of opportunities, etc., but the human rights, political rights, living in a convenient natural and social environment are also to be incorporated in the definition of the concept of welfare." (Doğan, 2011). In addition, it is stated in reference to Başkaya that the welfare indicators are insufficient if they are not calculated on the basis the environmental dimension involving factors such as gross national product (GNP), equality of opportunities in education, rates of child death, and nutrition (Doğan, 2011).

The concept of "Welfare State" emerged at the end of the 2nd World War. Economic policies were focused in order to erase the tracts of the war as regards to economic, and social state sense; and a model to form 'an ideal to remove the regional and country-based development differences'.

In reference to Çetin, “the Exogenous Development Approach” which was developed on the basis of the projection that there will be a prevailing movement from the developed to underdeveloped countries towards the 1970s, was accepted by the economic circles up until the end of the 1970s. (Doğan, 2011). After 1970s, on the other hand, “the Endogenous Regional Development Approach” was adopted and strategies were being developed in line with this approach. “Endogenous Regional Development is a development strategy giving importance to local resources, regional priorities, and endogenous potentials of local activities” (Doğan, 2011). This strategy included the aspiration to create a development strategy taking the history, resources and features of a country into consideration and determine the route for development. In addition, this strategy necessitated that each and every country should design its development processes on the basis of its own dynamics and all the countries should be commanding their own processes. The contents of the theses produced for these processes, on the other hand, shall be oriented towards “replacing the profit maximization with income maximization, prioritizing employment instead of capital, replacing the concern of private capital to increase the profit rates with the concern to increase life quality, prioritizing the purpose of material welfare instead of capital accumulation on the contrary of the neoclassical economic approaches,” as referred by Doğan, in reference to Başkaya (Doğan, 2011). As a result of the reflection of this approach to the daily life, it is also uttered by Doğan that “Regional Development Agencies” were established (Doğan, 2011).

The developments that are gone through after the growth of economic values and strategies, on the other hand, have been the previews of transition to a new industrial period. The technological developments are indicated to be the factors impacting the transition from the industrial society to information society. What is meant by technological approaches is the development of Information Processing Technologies. The development of Information

Processing Technologies has helped the removal of distances between the countries and increased speed in processes from information flow to conduct of commerce.

The fast ways of information transfer and easy access to any kind of information bring about changes in ways of conducting business through creation of a group of highly qualified and creative people who have the command of knowledge. This transformation is a preview of a new economic period, as well. This new period, which is discussed in detail under the below heading, is "Information Society and Economy."

2.1.1.3 *Information Society and Information Economy*

Together with the development and proliferation of the informatics tools, it has been observed that the circulation of information around the world has gained speed and access to information has become even easier. In addition, it has been observed that commerce started to be conducted through informatics tools (computer, networks, etc.), and communication and speed has become vital in economic, political, and social life. An innovation or invention which is realized in any point of the world is transferred to all points of the world via informatics technologies. People can access to information comfortably on individual basis, as well, and create added value for the economy through new business opportunities. Therefore, it is determined that all these developments increased the entrepreneurship.

Consequently, together with the transition to information society, the developments in the economic structure have been reflected upon the employment and worker profiles, as well. Well-educated and creative "information workers," who embrace their jobs, knowledgeable about their jobs, command the technology, own global equipment and who can create added value by transforming information do have an important role in this economic system (Uçkan, 2006). Besides this, the technological developments have also impacted the working conditions. The participation of women into the business life more than before, and the emergence of flexible or part-time shifts prevailed together with this period (Castells, 1996).

2.1.1.3.1 **Information society and development of information economy**

Information technologies that have started to develop in the last phase of the industrial society and the prevalence of these technologies, a new economic period has started. This period is named as "Information Economy" in the literature. It is frequently stated that not the countries that have the highest number of oil fields or giant industries, but countries or companies that produce the highest amount of and deal in information will direct the economy overall (Gültiken, 2006). According to this approach, information-based assets (patent, know-how, etc.) have gained critical importance rather than material assets in companies.

Uçkan stated that "in order to bring the information society into existence, it is necessary to construct an infrastructure for the information society and create a society in which good-quality education and lifelong education is accessible to everyone, and which consists of capable, flexible and creative people; create open, efficient and competitive information communication services and tools that are accessible to each and every layer of the society and a dynamic communication infrastructure; create a society consisting of creative people; create an efficient national innovation system and business environment in which entrepreneurship is supported by all the organized parts of the society, science and research centres, universities, intellectual production focuses and companies that are used in creating new products/services and new business conduction methods to contribute to the fast-growing global information stock. These are the fundamental four pillars of the information society" (Uçkan, 2006).

In order to constitute the information society permanently and consistently, it is necessary to develop a multifunctional national information policy; an executive model and strategy open to information sharing must be created with a conceptual framework. Uçkan underlines the fact that it is necessary to establish a strategy that encompasses the entire society from private sector tendencies, scientists, innovation developers, civil societies, and media to other parts of the society and found a strategy that contributes efficiently to the transformation to information

based economy, taking into consideration that the key sectors of economy should cooperate and develop in balance. It is also necessary to establish the relevant infrastructure for networks and information circulation. Besides, the author further states that it is a must to create dynamics gradually for information society by the society culture (Uçkan, 2006).

Castells (2007), a major source of innovation productivity of knowledge and information, it is stated that the training of basic materials, new production processes (Castells, 2007). In order for the information society to develop, it is a must to access to the information resources immediately. For that reason, this is one of the important factors in the creation of the necessary infrastructure that will activate information circulation for the establishment of information society / information economy or information society. The technical infrastructure that provides the circulation of information (internet networks, online access to libraries, etc.), perfect telecommunication infrastructure and not having limitations in network systems are important. Uçkan says that "considering the coordination, cooperation, and balanced development between the key sectors is the reason of successful information-based economy, the necessary conditions for an infrastructure convenient for network structuring and information circulation must be provided" (Uçkan, 2006).

Besides all these, the impeccability of the technical structure is not sufficient for the creation of information society on its own. It is determined the studies conducted that consistent policies in every field from education system, the ways of conducting business to business strategies are to be established. Touraine said that "A number of countries, being the Asian countries in the forefront, are in good conditions, yet the U.S.A.'s superiority is due to the university systems in particular, and the fact that universities function as pumps for the industry. These systems take and withhold the best students, and send the rest to their homes under strong impact; and this system outclasses as regards to information management" (Touraine, 2005).

Uçkan utters that the outclassing or superiority which is mentioned by Touraine is not just about technological leadership, but a strategic superiority for the management of information economy in global scale, and this is only possible through creating an economic input for the innovation, which is the dynamic of technology. In addition, he further states that this superiority can be realized through information management. The manager or managers of information decide the field in which the technology will be advanced and they also determine the roles of the actors within the economic system (Uçkan, 2006).

Stating that the global scale restructuring informational vary depending on the culture Castells refers to as to create added value for the investment as determined in accordance with the social purpose of production. At the same time, he stressed the value of the creation of surplus value according to the social structure of consumption and production. In this context, relations of production in the informational society; history, cultural, institutions, and the different responses in proportion to their freedom and are not included in the embodiments of the informational process increases the diversity of institutions in society (Castells, 2007).

In line with the above information, the changes in the information-based societies unavoidably have brought about changes in the business culture, as well. Consequently, the development of technology, emergence of ways of conducting business on the basis of information, and the technology's contribution to the ways of conducting business have led the changing of the employee profiles.

2.1.1.3.2 **Information society/economy employment and administrative structuring**

Economy and society structure on the basis of information unavoidably brings changes in ways of conducting business and, and in turn, employment processes. The most important change has been in the employees' profiles and ways of working. The employees of this period have accessed to information or have the ability to reach information; and it is also observed that they are well-educated, creative workers and they can adopt flexible working hours.

Furthermore, these knowledge workers have created added value to the economy and increase their competitive power through processing the data they acquire and using new product/service areas. The fundamental motivation of this working group, consisting of skilful and creative employees, shows difference from the previous period.

2.1.1.3.3 **Employment in the information society/economy**

The employees of the information society differ from the employees of the industrial society. Workers who have started to be employed in the "information sector" have been taking the place of the workers who utilize only the manpower.

Uçkan utters that "The competitive advantage in the information society has been replaced by creating new information and finding convenient human resources for the businesses" (Uçkan, 2006); having said so, he underlines the fact that "utilization of information, technological application, especially the Information Processing applications and relevant quality human resources rather that physical abilities are the tools for global transformation of workforce in the information society" (Uçkan, 2006).

Information or knowledge society and economy have entered the working life as "Knowledge Workers". Employees working in fields of "producing, processing, using and distributing of information/knowledge" are defined as "Knowledge Workers" (Erdem, 2010). Furthermore, Erdem, who states that employees who, in a way, contribute to the purchasing and selling of information and use information in their own work are called as "Knowledge Workers", as well; incorporates "a number of information technology groups such as programmers, system analysts, technical writers, academicians, researchers, etc. within the scope of the "Knowledge Workers" (Erdem, 2010).

The fundamental feature of knowledge workers are being flexible, creative and able to command the work they conduct. Knowledge or information is both the input and output for

these employees. In other words, information is both the raw material and finished product for the employees.

Differently from the industrial society, qualitative products of the employees rather than quantitative products are more in the forefront in the information society's business system (Kocabaş, 2004). Kocabaş describes this change in terms of workforce saying "computer, communication, and micro electronic technologies called as information technologies have gained weight in the economy; and this allows these new thoughts, systems, events, and products to enter into anywhere without limitation. Naturally, the technological development coming together with the structural change in economy has caused changes and alterations in the production process, workforce structure, organization of the job and workplace" (Kocabaş, 2004).

Erdem emphasizes the autonomous structure of the knowledge worker and that it is necessary to meet their needs of continuous education, they want to see themselves as the part of the production process and the knowledge workers are the ones the make the decisions in the businesses thanks to their experiences. Furthermore, Erdem who says that "it is impossible to satisfy the knowledge workers with the traditional methods," also utters that normal rewards and other motivation techniques are not sufficient for these workers; these workers need creative, comfortable and enjoyable working environments and their efficiency will increase if they have such an environment. In order to increase the workers' motivation, it is necessary to focus on the characteristic of the knowledge workers, according to Erdem (Erdem, 2010).

When taking into consideration that the most important feature of the information/knowledge society is "innovation", it is fairly deduced that the "Knowledge Workers" will be more creative, they will continuously update their knowledge and they will make it usable and they will commercialize the information they acquire. They want to take part in the "learning organizations." This alteration in the business life has caused an increase in the qualified

workforce in the economy, and changed the working standards. Together with the globalisation, the most important change, which is come across in "the Information Economy", has taken place in the working hours. The change in the production models has altered the traditional manners of working thanks to the technological developments; part-time working, and flexible working hours has prevailed as a result of this process. Kocabaş states in reference to Erdut that "the necessity to adapt to the changing conditions of competition has propounded the transition to flexible working styles such as flexible production, periodic working in the workforce employment, and home-office working" (Kocabaş, 2004). Another manner of working is working on the basis of the project. Kocabaş states that "workforce styles such as part-time working, temporary employees, even working in the call centres, and home-office working have been established in the new employment style" (Kocabaş, 2004).

Kocabaş stated in reference to Koray that; "Flexible use of workforce creates non-standard (for instance, subcontractors and temporary workers, etc.) working styles, on the one hand, and paves the way for the individualization of the wages and working conditions" (Kocabaş, 2004).

2.1.1.3.4 **Administrative structuring in information society/economy**

Cooperation and administrative understanding which is oriented towards motivation has been developed in the knowledge (Information) society. The organizations' priority is not to manage huge factories in the new age, but manage information. As regards to the fact that information is power, Drucker stated that; "the most meaningful resource of today is information", while Steh uttered that "societies are organized around information and knowledge".

The dissemination of knowledge or information gains speed through the Information Communication Technology (ICT), and the organizations will follow up the present information in this period, when production of knowledge has gained, as well; the information will be processed and improved in the organizations and they will inevitably create a sense of administration. Koçel remarked that "the major subjects in the 2000s administrative sense are

quality, global competition, differences, empowerment, virtual network structuring, team work, innovation, and production of knowledge" (Koçel, 2005). In addition, as the companies build their structures in different and complex environments to comprise the entire world (multinational organizations), it is necessary to take the legal, economic, and political variables into consideration, as stated by Phatak; and the organizations get affected from the opportunities and threats of the exterior environment (Phatak, 1984). The change in the way of conducting works creates change inevitably. Although central administration is impactful in the state structure and business world in the industrial society, it is seen that decentralization has been adopted.

Barca defines this sense of administration as; "transformation of strict and central structures to the democratic ones which are based on knowledge and information". Barca also remarks that there has been transitions from national to global economies, centralization to decentralization, representative democracy to pluralistic democracies, and from hierarchy to network organizations" (Barca, 2002).

The change, which is gone through in the administrative structure, has shown itself in the hierarchical structure, as well. Vertical organization structure emerged in the last phase of the industrial society, as a necessity of the acceleration in the ways of conducting works. Network structuring, on the other hand, emerged as a necessity of the information society. Network structures of the organizations, clusters, technological development monitoring, accessing to information, and information transfer are needed to be speeded up in the information society/economy, and this has paved the way for changes in the organizational structures accordingly. The more the information hubs are powerful, the more powerful the production of new commodities, access to information, and having a say in the economy are. While the organizational structures were horizontal up until the 1980s, a transfer to vertical structures has been gone through in the 1980s. Decisions were being taken faster, and information flow was

being carried out smoothly in the organizational structures after 1980s, together with the ICT technological developments. Of course, these transitions were not sharp. Three organizational structures are present today. The differences between these structures are shown in Figure 1.

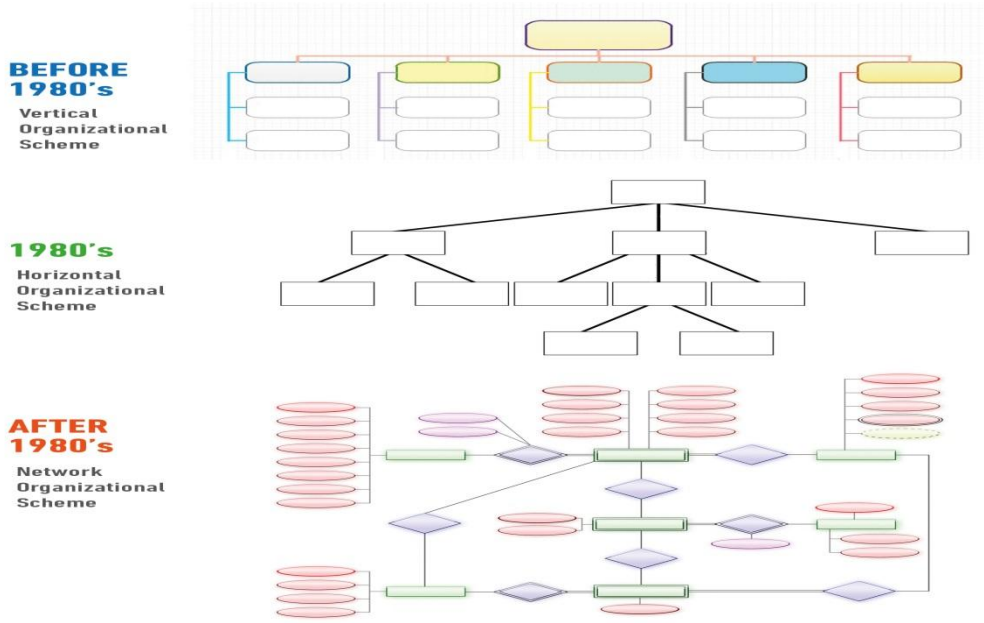


Figure 1. Organizational Structures

Castells uses the term "Information Society/Economy" instead of "Knowledge Society", which is another term used in the field. Castells explicates that informationalism depends on technological development, collection of information, and focusing on top levels in information processing. Furthermore, Castells propounds that information production, processing, and communication technologies with symbols are the resources of development in the information layers (Castells, 2005).

This change, which is called as informationalism, according to Castell is the restructuring of capitalism, and processes which do not differentiate from each other in global scale show different reactions depending on their historical and cultural structures, and peculiarities. Differences come out in the adoption of these processed by the societies, depending on their structures, as well (Castells, 2005). Even if there is system, which is based on production, effort, manpower, and individual effort, in the industrial society; there is a new economic

system, as claimed by Castells, in the information society, in which the information and services sectors are primary work fields (Erkan, 1994).

The differences between the Information and Industrial Societies are shown in Table 1; and they are indicated under seven groups, being the Period, Space, Tools, Style, Internal Tendency, Threats, and Building Blocks.

Table 1. *Industrial Society and the Information Society Differences between Employment*

	INDUSTRY SOCIETY	INFORMATION SOCIETY
PERIOD	The Giant Factory Age	The Giant Brain Age
	Industrial World	The Digital World
	Men's World	Everyone's World
LOCALITY	Industial City	Universal Village
	From the land to the Factory	From the Factory to the Office
TOOLS	Steam Machine	Spaceship
	Machine	Computer
	Machinery Infrastructure	R&D Infrastructure
	Machine	Idea & Invention
	Telegraph Network	Informatics Network
FORMAT	The Giant Factory	Miniature Office
	Hierarchy Levels	Network Channels
	Human body and central nervous	Brain and virtual network system
	Organic Vineyard	Digital vineyard
INTERNAL TREND	The Accumulation of Capital	The Accumulation of knowledge
	Property Spirit / Spirit of Capitalism	Spirit of Enformasyonalism
THREATS	Workers 'and Employers' War	Information War
	Industrial Espionage	Espionage in the Silicon Valley
BUILDING BLOCKS	Atom	Byte
	Book	Image
	Paper	Key
	Cogwheel	Chip

Note: (Kutanis, 2007)

2.2 Historical Transformation of Universities

The foundation and transformations the universities have gone through up until this period will be scrutinized chronologically in three periods in this section. The changes in today's education paradigms of universities, and, besides the universities main functions, the reasons of their assuming the mission of creating values as regards to education-training and innovation by involving in the country's economy through contributing to the industry will be scrutinized; the

reflection of economic and social transformations on the strategies and education systems of universities are touched upon in this section, as well. Briefly, the main focus of this study will be the universities, their historical development, the stages they have gone through to reach today's conditions, their strategies, and the way the collaboration between universities and industry is constructed.

2.2.1 **History**

The commencement of universities in today's sense dates back to the late 11th century in the literature (Antalyalı, 2007). "First universities that were founded in the Middle Age Europe were the universities of Bologna, Paris and Oxford. Although there is not clear information on the exact dates of the foundation of these universities, the University of Bologna is believed to be the first university to be established according to common view. *The date for the establishment of the University of Bologna* is accepted to be *1088*. The university which was established after the University of Bologna in France in 1150 was is University of Paris. After a short while, *University of Oxford* was established in *Britain in 1167*. These three universities are categorized especially with their financial dimension. University of Bologna was established by the students' guild and was a school where the salaries of the educators were being paid by the students. University of Paris was more like an educators' guild and the salaries of the educators were paid by the church. The salaries of the educators in Oxford University, which was established by state grant, were paid by the state." (Antalyalı, 2007).

Following the three universities explicated above, the universities of Montpellier, Padua, Orleans and Cambridge were established, and these universities altogether come out as the seven oldest universities within the scope of history of universities.

The proliferation of universities in Europe took place in Spain, France, Britain and Italy in the 14th century. The number of universities in Europe in the 15th century was stated to be 63. "All

of the universities established within this period were founded either by presidencies or local governments" (Öztunalı, 2001).

Antalyalı provides information on the role of universities in the process of historical development by giving reference to Küken and Doğan, saying "The cults of Franciscan and Dominican who entered into the circle of universities in the 13th century considerably impacted the routes of the universities. The cult of Dominican, which played a role in the systematization of the Christian thought, put efforts for the adoption of philosphy, played a role in the restructuring of scholastic method and; as a result of these processes, planted the seeds of the Renaissance. Franciscans, on the other hand, directed themselves towards science and had considerable impact in the development of scientific thought" (Antalyalı, 2007, s. 28). It is stated that the missions of the universities in the Medieval Ages were different from today in the sense that they were solely focused on "education". In reference to Rukancı, Anameriç, and Antalyalı we can fairly utter that "even especially in fields of those universities such as theology and philosophy where it is quite possible to make a broad expansion, lecturers transferred what they had known to their students, and students, in return, recapitulated what they had learned when asked questions. Discussions carried out in this field generally aimed at recapitulating what had been taught in the past and getting the students adopt rhetoric (Antalyalı, 2007, s. 28).

Because of the conditions of the period and needs of universities, the autonomy of these institutions lost its value and they adopted a status quoist stance in the late phases of those medieval universities. Antalyalı explicates that the conditions for universities towards the end of the 18th century were not bright, yet the relevant conditions were positive in terms of orienting universities towards research and scientific development.

In addition, although an increase was observed in the number of universities, which incremented to 190 in late 18th century, it is frequently uttered by experts that there was not any

increase in the quality of universities at that time (Antalyalı, 2007). Although the universities in this period are observed to be of heterogeneous structure, similarities they pose in financial terms attract attention. Antalyalı determined these similarities in reference to Geuna as such: "University revenues can be examined under two dimensions, being internal and external resources (Geuna, 1996). Internal revenues (resources) are: a) Registration and graduation costs; b) exemption; c) fund raising, which means, for instance, collecting money from students once or twice a year; d) and disciplinary penalties. External revenues, on the other hand, are: a) religious relieves; b) salaries paid by the church, king, duke or local governments; c) gifts and heritages; d) and the donations granted for the sustainability of the universities. Although expenses for the universities in early periods were at a modest level, expenditures incremented afterwards, in parallel with the development of universities and increase in investments (houses, buildings, libraries, etc.). Expenses can be ranked as: a) lecturers' salaries; b) managerial costs; c) officials' salaries; d) lawsuits; e) academic and religious ceremonies; f) and acquisition and maintenance of houses, buildings and libraries"

(Antalyalı, 2007).

In reference to Öztunalı's report, Antalyalı claims that the dependence of universities subjected to local governments were increasing, and the number of university students were decreasing as occupational education was being provided outside universities (Antalyalı, 2007). In reference to Scott, it has been propounded that the seeds of nationalization of the missions of universities were planted together with the Renaissance, and "Nationalization is apparent in the first universities in the sense of modern universities in Europe and Latin America. Detailed examination of Grandes Ecoles, which entered the literature as a French Model and where the mission of nationalization of universities was most distinct, is vital in terms of comprehending the roots of one of the fundamental missions of today's universities." (Antalyalı, 2007). Grandes Ecoles was a structuring initiative referring to higher education in the 19th century, and

its fundamental purpose was to train qualified personnel who would help develop the French nation. The fact that the research activities were central was the most striking feature of this period (Antalyalı, 2007).

It has been propounded that the foundations of modern universities were laid by the emergence of German model in the early 19th century. This approach, which was created dependently on the German idealism, differs with its belief in education on the basis of science. This mission, which prevailed in the U.S.A and Japan after Germany, constituted the fundamentals of modern universities (Reed, 2004). In reference to Hartwing, Antalyalı identifies the other important factors of this period as "freedom of education and research, uniqueness of science and dependency on research necessity." Humbolt, who differentiated the university education from pre-university education, states that university is not a place where the lecturer is the central element; and students are not to be seen as people dependent on the educational program without any contribution; "student is a person who undertakes his/her own research, and professor is the person who directs and supports the student" (Antalyalı, 2007).Together with Willhelm von Humbolt's reform in the early 19th century, which encompasses "research" among the missions of universities, and the university modelling pioneered by Germany, the fundamentals of universities in today's sense were laid (Reed, 2004). This concept was constructed on the basis of the German philosophical idealism and it accepts the idea that the knowledge produced by universities has educational value, by combining "science and education" and without any disintegration and compartmentalization.

Furthermore, the idea of "freedom of education and research, uniqueness of education, and dependency to the research necessities" takes place within the concept of this approach, and according to Humbolt, "production of knowledge is under the responsibility of the universities, as much as its protection and communication (Antalyalı, 2007). According to Humbolt's

approach, the students shall be free in and responsible for arranging their own academic program; the professors, on the other hand, shall guide and support the students.

It is also emphasized in the same source that "the production of knowledge is under the responsibility of the universities, as much as its protection and communication" according to Humbolt, (Antalyalı, 2007). Although Antalyalı is influenced by the American and German universities, he states that American and German universities are different from the European universities in terms of structure, as "the professors in America do not have a historical tradition of guild and strong state tradition and occupational organization in the sense of guilds, which are determining occupational standards in certain countries in Europe, are lacking in America" (Antalyalı, 2007). Antalyalı also remarks in reference to Brubacher and Ruby that the American universities have an understanding of education which is based upon "community oriented responsibility" depending on the 19th century reforms. In line with this understanding, there have been changes in the academic structure of universities, as well; in that the "professorship chair" was replaced by the percept of "department." Wassong asserts that this new percept allows students from different fields study in detail without being overwhelmed under a stern curriculum, and that progressive education can be possible through exchanges of opinions between the university professors and politicians (Wassong, Stephan, 2004). With President Jefferson's initiative, extensive efforts were put in order to make people accept the idea that universities are institutions from which any capable person can benefit" in the 19th century's America" (Antalyalı, 2007).

Universities were opened to the society and the market, and they started to be shaped upon the coming demands. In comparison with the German universities' pure science for science understanding and British universities' elitist understanding of education; the 19th century reforms in the American universities were founded upon the concept of community-oriented responsibility (Brubacher and Rudy, 1976: 404-405 referred by Antalyalı, 2007).

Jones says that America's different structural necessities were influenced by the social circumstances and they were just shaped after the second half of the 19th century; "with the impact of the newly-formed American circumstances for universities in the 20th century, the German model was adapted to the American universities, and certain innovations of that model were exported approximately to the countries all over the world (Jones, 1992, referred by Antalyalı, 2007); and these innovations have had vital effects on the 20th century percept of university" (Antalyalı, 2007).

As stated above, extensive efforts were put in order to make people accept the idea that universities are institutions from which any capable person can benefit" in the 19th century's America on the basis of President Jefferson's initiative. Upon this fact, a system of scholarship was developed and universities turned out to be open for any qualified person, rather than to the privileged groups or people who have a certain level of income. This approach, which is called as the Jefferson Model, is founded upon equality and utilizes the innovation method and pursues the mission of democratization in order to be able to serve the individuals. The terms of "equal opportunities," "diversity," and "open access" that we use today were among the objectives of the Jefferson Model (Scott, 2006). Even though the distance between the universities and society was protected with the relevant model, this model allowed "universities to be open to the society," and "locate the relationship between universities – environment as one of the objectives to be attained by universities," differently from the past models (Antalyalı, 2007). It has been in our literature that the changes in the structuring of American universities started to prevail in Europe in the globalizing world, and the understanding of public service, out-of-campus education, applied studies with educational institutions by entering into a re-structuring process on the basis of the society and environment point of view has been the primary tendency up until today. Antalyalı propounds that the 20th century universities have

four fundamental missions which are education, research, democratization, and public service (Antalyalı, 2007).

Wissema shows the history of universities schematically as below in Figure 2:

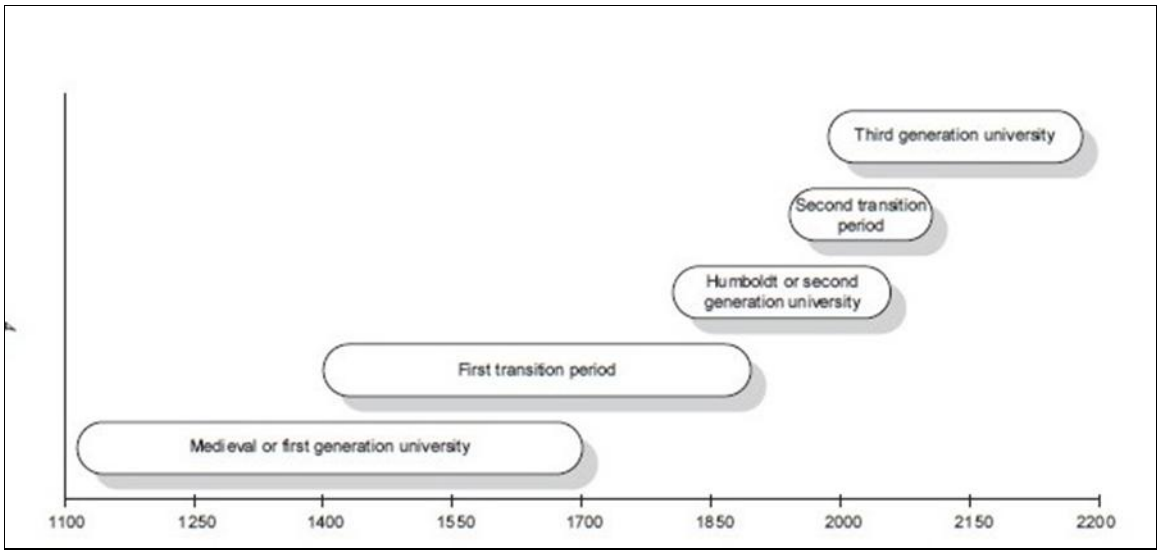


Figure 2. *History of Universities* **(Wissema, 2009)**

2.2.2 **Stages of change in university models**

When the structuring processes of universities are examined historically, it is observed that they complete three fundamental phases. It has also been witnessed that universities are structured as "education", "research" and "entrepreneur" universities during the course of this process. This change, which takes place in the nature of science, as well, is explicated by Genç and Eryaman as a pragmatic change "in favour of learning", and they also stated that changes taking place in the social structure have also impacted the shift of focus of interest towards learning. They remarked that "Developments in the field of democratization and human rights have led the way for the democratization of learning, as well, and supported the individual to focus on his/her own interests, abilities and preferences; and paved the way for an increase in the alternative educational programs and school diversity, and individualization of the learning process" (Eryaman, 2008). Eryaman and Genç express that the aforementioned changes impact the presentation and content of the curriculums, as well.

In addition, Aktan claims that globalization, international exchange programs and competition, and techniques such as the development of ICT and e-learning also cause the paradigms in higher education to change. Besides these, it is observed that the universities are are structured in line with the day's conditions as they are impacted by the economic changes they go through in their historical process. Aktan determines that "The changes in economy, political institutions, socio-cultural values, field of science and technology, and a number of other fields are effective in the changes taking place in higher education services, the concept of university and management models (Aktan, 2007).

Eryaman and Genç stated in reference to Akman that "The concept of information society can be defined as; a development phase in which the information sector, information production, information capital and qualified personnel factor have gained importance through the development of new fundamental technologies; the sustenance of education comes to the forefront; and it is a phase that carries the society beyond being merely an industrial society in terms of economic, social, cultural and political aspects through new developments in the communication technologies, data highways, electronic commerce, etc." (Eryaman, 2008).

According to Sakıç and Bursalıoğlu, "The universities, the "education" aspirations of which are preponderated, have undertaken the mission of being a "researcher" university in line with the needs of the industrial society in the valid period. In today's process, on the other hand, universities have adopted the idea of contributing to the economic and social development as a third mission. This process is conceptualized through different ways." Furthermore, these scholars have also uttered that the "social contract" which is deemed to be existent between the state and universities can be exemplified by approaches such as "the transformation of information production processes"; "triple helix approach" (Bursalıoğlu, 2012).

Together with the increasing competition in the field of education, as in all other fields, and the transition to "massive education"; the institutions of higher education started to put efforts to

increment their sources, and Bursalıoğlu uttered in reference to Küçükcan and Gür that the increasing number of students due to the immense competition and transition to massive education in higher education in the 1990s incapacitated the public resources and pushed the institutions to pursue alternative resources. The reason for the creation of entrepreneur university model or the transition to "3rd Generation University" as named by Wissema, is fundamentally the globalization, as it is impactful on universities, and other layers of the society. Partially because of the internet, the English language has become the new universal language facilitating considerably the communication and access to information resources. Universities had to provide their classes in English and this, in turn, increased competition. "The fact that universities started to accept the grades of other institutions providing undergraduate and post-graduate education increased the competition in Europe even more" (J.G.Wissema, 2009). Thereby, Bursalıoğlu adds the language factor to the reasons of the development of and competition in the usage of a common language.

Erdi and others stated in reference to Etzkowitz that adding research activities to the fundamental missions of universities was the first academic revolution, and the works carried out to create economic added value to those activities was regarded to be the second revolution. "After 1980s, the second revolution, which added the duty of *contributing to the economic and social development* of universities' to the fundamental missions carried the concept of entrepreneur university into the agenda and turned the universities into active players within the system of national innovation" (Erdi, Pamukçu, Akçomak & Yelda, 2013). It has been observed that universities started to support the economical actors and realize the transition to an entrepreneurial structure as a result of the aforementioned transformation. Bursalıoğlu and others stated that universities were oriented towards outsourced projects and the process of "*incorporation*" in which students were treated as "customers" (Bursalıoğlu, 2012). It can be deduced that this situation directed universities towards being entrepreneurs. The internal and

external factors effective in the relevant transformation, on the other hand, are identified by Rinne (2009) as "(i) the formation of the European Higher Education Area-EHEA, (ii) the demand for more autonomy, (iii) international competition; and the internal factors are identified as (i) the mechanism of traditional culture and management, (ii) academic capitalism, (iii) initiative activities, (iv) and the role of universities in the system of higher education" (Bursalıoğlu, 2012).

The common view in literature is that the educational systems are affected by the developing and changing socio-economic approaches in the world and transformation in the field of education is unavoidable. Together with globalization, the point of origin of the Entrepreneur Universities is the "Entrepreneur University Model" which emerged in Germany in 1800s and in the U.S. afterwards.

Within this period, which is named as the second transitional period by Wissema, "Entrepreneur University was identified as the initiatives taken for turning knowledge into commerce, new organization structures; marketing techniques utilized to attract more students and academicians, new financing methods (donations and others)" (Wissema, 2009). Wissema claims that the reasons and results of the formation of entrepreneur university are; the increasing number of students in universities, interdisciplinary studies, globalization, increasing of research costs, emergence of special research institutes, and the inevitability of the cooperation between universities and the industry fields as a result of all these changes on the basis of economic transformation. The history of the cooperation between the universities and the industry will be explicated in the next section.

2.3 **The Cooperation between University – Industry**

In this section, the history of the cooperation between university and industry, and the duties and responsibilities of the universities, industry and state within this model will be scrutinized on the basis of the "triple helix model." Along with that, the interdependent expectations of

universities and the industry, the ways they contribute to each other are also analysed; and the tools utilized for the robust continuation of these relations will be discovered.

Within this context, the ways the university models have developed in the world, the processes they have gone through, industrial cooperation they have had, and the duties of the state will be investigated.

2.3.1 **The history of the cooperation between university and industry**

Although the starting date of the cooperation between university – industry is not determined clearly, it has been asserted that scientific historians dated back to the 17th century Britain. Erdi et al. set sights on producing a product catalogue which transferred the way how the fundamental products were generated in detail, on the basis of the "history of trades" program having being shaped upon Francis Bacon's views in the early 17th century. By this way, producer could learn from each other, and beyond that, scientists could come up with solutions to the problems emerging in the production process. Bacon suggested that "scientists who blended science with the producers' points of views, would contribute more to the development of science" (Erdi, Pamukçu, Akçomak & Yelda, 2013). Erdi et al. uttered that this idea was realized in the Royal Society of London, and that actions were taken in line with this idea in London, and this, in turn, paved the way for the laying of the foundations of the cooperation between universities and industry to further result in the Industrial Revolution (Erdi, Pamukçu, Akçomak & Yelda, 2013).

It is seen that the first step taken to form an innovation system in the literature reviews was the idea of starting using and applying knowledge in the field of industry. Universities had to act in way that would create difference in order to be able to contribute to the industry and forge ahead in competition; and they adopted the structuring of "Entrepreneur University" to create cooperation with the industry for supplying the economy with added value. This transition is still in process today. Erdi et al. believed that the underlying factors in partnerships created

between the industry and university are the high costs of knowledge production and technology development, and insufficient government grants; and the universities had to create new sponsor and industrial collaborations as a solution for creating new sources for conducting research. As a result of this, it is stated by various scholars that cooperation is strengthened together with the increase in the contributions made by the industry to the university researches (Erdi, Pamukçu, Akçomak & Yelda, 2013).

Bursalıoğlu defines the research universities founded in Germany in the 19th century for the first time as modern and entrepreneur universities, claiming that entrepreneur universities shape on the bases of creativeness, innovation and transformation; and that a connection can be made in terms of the "entrepreneurship" concept (Bursalıoğlu, 2012).

Wissema also utters that together with the establishment of special research institutions in the same line, a forward step is taken to develop industrial collaborations in the university strategies. Etzkowitz, on the other hand, mentions about the university collaboration with the pharmaceutical industry which started in 1800s and explicated the creation of official consultancy and academic researches collaboration between Harward and MIT in the 1900s (Etzkowitz, 1998).

Bursalıoğlu et al., who gave reference to Odabaşı, propounded that "The entrepreneur university model continued with the academic personnel in the researcher and innovative American universities such as MIT and Stanford providing consultancy services in the fields of industry and commerce through the end of the 1800s, and this tradition prevailed to European universities such as Cambridge and Twente today; this process continued with numerous developments including the foundation of independent institutions working between the universities and the industry and facilitating new features and functions to universities. Without constituting impediments to their traditional functions of education and research, universities

show transformation oriented towards increasing regional, social, and economic welfare whereby interaction with the industry" (Bursalıoğlu, 2012).

The theoretical structure of the entrepreneur university is identified by Bursalıoğlu in reference to Etzkowitz's 1983 work as "…the university [model] which facilitates cooperation with a private enterprise, activities such as contracted research, and patent; and provides new financing resources." It was defined by Chrisman et al. (1995) as "the formation of new initiatives by the university actors (academicians/technicians/students)"; "[an institution] which conducts research upon the ways to make the business world more innovative and creative" by Clark (1998); "a university based on both commercialization and commodification (Guerrero-Cano et al., 2006)" by Jacob et al. (2003) (Bursalıoğlu, 2012).

Also, in the literature, some researchers would be appropriate to express terms of university-industry convergence instead of university-industry cooperation. Also, in the literature some researchers would be appropriate to express terms of university-industry convergence instead of university-industry cooperation. According to Eynür, "It is decided to seek a convergence between industrial and academic world positioning the focus to the educational entrepreneurship, edupreneurship" (Eynür, 2014)

Bursalıoğlu further states in reference to Siegel that in order to characterize a university as an entrepreneur university, academicians who are internal stakeholders should found their own companies, students should be educated like entrepreneurs, and students should raise awareness in terms of technology and innovations; and the most important propellant power of the entrepreneur universities is the establishment of university-industry cooperation. He also asserts that Siegel claims that there are three different stakeholders directly concerning the university-industry relations and that he characterizes these stakeholders on the basis of various strategies and fields. Table 2, categorizes universities according to different strategies and fields on the

basis of the assertion that there are three different stakeholders directly related to the "university-industry relations" (Bursalıoğlu, 2012).

Table 2. *Stakeholder in the University-Industry Relationships*

Stakeholders	University Scientist	Technology Transfer Offices	Company/ Enterpreneur
Actions	The discovery of new knowledge	Working with faculty and companies	Commercialization of new technologies
Primary Motivations	Science is accepted in the society	The marketing of intellectual property of the University	Financial Income
Secondary Motivations	Supplying financial gain and additional research funding	Providing additional research funding and spreading technological	Maintain control of patented technology
Organizational Culture	Scientific	Bureaucratic	Entreprenuer

Note: *(Siegel et al. 2010)*

The purpose of the entrepreneur universities is to produce entrepreneur graduates who are producing, creating added value for the economy rather than producing graduates who just own diplomas and look for a job. The academic entrepreneurship applications of the universities, on the other hand, are focused on "contracted research", "consultancy" and "external education" carried out together with the industry or public institutions (Bursalıoğlu, 2012). The role of the entrepreneur universities on the industry is demonstrated in Figure 3.

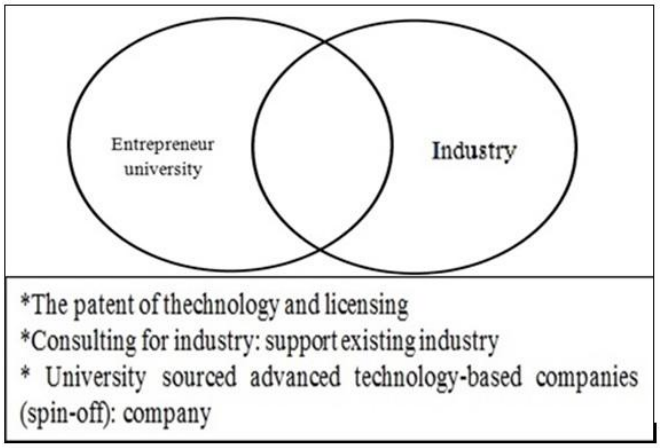


Figure 3 *Entrepreneur role of university industry (Etzkowitz & Zhou, 2007).*

Wissema speaks of the fact that the existence of 360 active consultaning companies, in which there were think tanks from the Cambridge University to solve the problems of British industry in Cambridge in 1960s, was mentioned in The Economist newspaper (Wissema, 2009).

2.3.2 **The role of the universities**

As stated in the history section of this study, it has been observed that the transformation that took place in the universities' structures, management methods, missions and education paradigms caused by globalization has led them to evolve into places that contribute to the society and works to make universities contribute more to the industry have increased.

Information has become the fundamental source and this has paved the way for the necessity of universities to undertake active role in the creation of an innovation ecosystem. Drucker said in order to express this concept that "Information has become the fundamental source in the post-capitalist society that goes through a globalization period," and that the concepts such as "Information Age", and "Information Society" are used to describe this new understanding of civilization. Antalyalı states that universities are institutions which are positioned in the fundamental axis in the post-modern world thanks to their role in creating and conveying new information rapidly, and they have reached to an international perception, supporting Bell's views (Antalyalı, 2007).

Aktan said that together with the impact of the technological development in the information society; information production, information capital and qualified labor force has come into prominence and this process can defined as a development process beyond the industry society in terms of economic, social, cultural and political respects with the development of activities such as continued education, communication technologies, information high-ways and e-commerce (Aktan, 2007).

Eryaman et al. asserted that the creation of information society is necessary in order for the creation of the innovation ecosystem as "Informed people, and organizations; and 'learning

individuals' and 'learning organizations', in turn, are the fundamental factors in the creation of the information society." Herewith, Eryaman says that the fundamental characteristic of the information society takes form as the learning society (Eryaman, 2008). Besides that, the most fundamental feature of the understanding of global approach to education finds expression to be the interdisciplinary study. It is stated in the literature that the globalizing education supports interdisciplinary research, teamwork, creation of environments in which individuals can discuss, compromise and become skillful at communication; and development of management skills accordingly (Eryaman, 2008).

Şentürk underlines that in the understanding of quality education; educators adopt and act according to the principle of leading instead of patronizing (Şentürk, 2008). The transformations in the education system, opening technology to the world, and accessing to the current and new information are important in terms of opening up individuals' horizons in the education process. Şentürk believes that the developments in the world right now are in line with this assertion, and says; "Societies, organizations, business organizations which are able to see these facts prioritize education in order to take part in the new world order, gain power and protect themselves against probable risks." (Şentürk, 2008)

It is underlined that the relevant is provided by the "entrepreneur university" model in the changing world. The expansion of universities outside the institutions paves the way for the increasing of the collaboration with the industry. Bursalıoğlu states in reference to Yamaç that while this structure decreases the level of dependency of the universities to state resources, there is a risk of losing identity; and that the ways of university expansions include technology transfers, cooperation with the industry, and facilitating financial resources (Bursalıoğlu, 2012). While Çetin accepts the aforementioned risks, he says that the entrepreneurial structure will not impact the fundamental functions and characteristic structure of universities. This structure will not turn the universities into commercial entities and make them wardens of the industry. Yet,

he also states in reference to Anderson that there are three potential risk groups: a. 'Business Risks', which refer to the possible money loss for the commercial initiatives, b. 'Management Risks', which refer to the value judgements in assessment and control and the excessive amounts of objectives, c. 'Image Risks', which refer to the interruption of public supports, abuse of corporate culture and objectives, and damage to the image of service-oriented organization. Despite all these risks, Çetin emphasizes that the innovative structure of the entrepreneur university is necessary in terms of regional and national development in an environment of international competition (Çetin, 2007).

Etzkowitz states that the university-industry cooperation and works for increasing the amount of economic and social contribution, except for the contribution in the education – which is the fundamental activity of universities – have gained importance after the 1980s; and in addition to the first revolution coming from Europe in this field, the second revolution has come from the U.S.A. regarding universities coverage. This development produced the idea of "Entrepreneur University." Information has become an important factor in the development of new technologies and, as a result, information has gained economic value. Universities, on the other hand, have taken an active role in creating added value in the national innovation ecosystem (Etzkowitz, 1998). It is also asserted by Erdi that the contribution made by the information production to the creation of new products and technologies is the basic foundation of economic development.

Erdi states by giving reference to Schartinger that "Accumulation of knowledge is accepted to be one of the important dynamics constituting the foundation of the innovation systems approach and paving the way for the production and dissemination of information, and leading technological transformation. If we consider universities as sources of new information and views, we can fairly state that direct access to the technologies, based on the research conducted in the universities by the educators who produce information, started to bear strategic

importance in terms of industrial enterprises." (Erdi, Pamukçu, Akçomak, & Yelda, 2013). Setting up a substructure for the information production and technological development brings considerable amount of capital. Although a certain amount is paid by the state subsidiaries, the diminishing financial sources created a necessity for seeking alternative sources and funds; which, in turn, paved the way for the industry to contribute to the research activities conducted by universities. Cooperation between the industry and universities contributed to the development of both sides, and facilitated sustainability for the works carried out. While companies benefited from academicians in the product and process innovations within the scope of this cooperation; the universities have access to the sources and opportunities that facilitate efficient realization of activities in research fields (Erdi, Pamukçu, Akçomak & Yelda, 2013). The reasons why universities cooperate with industrial enterprises and the universities' gains from this cooperation are summarized in Table 2, on the basis of Erdi's study incorporating the data acquired from the U.S.A. National Science Foundation (NSF) in 1982.

Wisemma asserts that many science-based companies are conducting research in the field of science partly because they want to protect and expand their positions in the market, and partly because they are accustomed to carry out scientific research, after a number of Research & Development organizations quitted conducting researches in fundamental sciences. Wissema, who states that this caused the cessation of fundamental scientific research, and there is restriction in fundamental scientific research concerning the working areas, believe that cooperation with the academic institutions is indispensable, as companies are obliged to seek other solutions for the aforementioned restrictions in the working areas (Wissema, 2009).

Consequentially, it has been observed that the universities are in quest of new sources, because of the transforming company strategies, and to meet their financial needs and to conduct their fundamental researches, as well. Academic studies have become inter-disciplinary thanks to the globalization and technological development; and conducting researches which are responding

to the needs of the market have become only possible through the transfer of fundamental information to the companies by the academy. In addition, it is in literature now, that the universities have an objective as to utilize and develop knowledge, and undertake the role of creating added value for the economy, besides their education mission.

Wissema expresses the development of universities, dividing them into three groups as the first, second, and third generation universities; and the distinctive properties of those universities are described with the key words in Table 3.

Table 3: *Characteristics of Universities*

	Characteristics of the:		
	First generation university	Second generation university	Third generation university
Objective	Education	Education plus research	Education and research plus know-how exploitation
Role	Defending the truth	Discovering nature	Creating value
Method	Scholastic	Modern science, monodisciplinary	Modern science, interdisciplinary
Creating	Professionals	Professionals plus scientists	Professionals and scientists plus entrepreneurs
Orientation	Universal	National	Global
Language	Latin	National languages	English
Organisation	Nationes, faculties, colleges	Faculties	University institutes
Management	Chancellor	(Part-time) academics	Professional management

Note: *J.G.Wissema (2009)*

2.3.3 **The role of the industry**

Cooperation with universities takes shape fundamentally as the contribution level of universities to the industry in industrial regards. The globalization and increasing competition pushes the industry to cooperate with the academy in order to be able follow up the rapidly developing and renewing world. Besides that, the endeavour to protect their company prestige

supports the necessary cooperation. Furthermore, the needs of the companies or the relevant sector for new information, and the production of this information by the universities constitute another important factor empowering this cooperative relation. The fundamental scientific studies and researches provided by universities for the industry serve the companies' endeavour to forge ahead in global competition.

Wisemma states in relation with this circumstance that a number of companies cancelled their research programmes in fundamental sciences, and got access to the fundamental scientific knowledge through universities, which are free research institutions. Besides this fact, Wissema asserts that the relevant cooperation is not limited with the fundamental research, and universities act as development offices for small enterprises and they provide these small enterprises with the necessary knowledge: "…universities, which poses the knowledge and expertise to play the game of acquisition, benefit considerably from accessing to the resources and data of the companies" (Wissema, 2009).

Another reason for the industry's cooperation with the universities is the direct acces to the growing human resources. The fact that students who, receive theoretical education, find an opportunity to practice in the relevant sector via the cooperation with the industry facilitates the necessary human resources (Kıncal, 2011).

The cooperation between the universities and the industry is based on the win-win principle. On order for the creation of international industry, it is necessary to produce, transferring technology is not necessary on its own; it is stated by various scholars that failing this would hinder international market competition or acquisition of market share. In addition, the relevant cooperation will lead to effective usage of scarce sources and decrease the cost of R&D initiatives (Yücel, 1997). Within this context, the expectations of the industry from the university-industry cooperation are demonstrated in Table 4:

Table 4: The Expectations of Industry

The Expectations of Industry
• The variability of the order of priority in the industrial sector • The rapid changes and developments in national and international competition. • The reconstruction needs required in the operating procedures of the industrial sector. • In the planning stages in the production process, a detailed analysis of demand. • The need for continuity in education. • In the R & D efforts, the need for two sectors of the collective work. • The need for change and renewal in the staff's understanding of the industry valuation • The capture of the quality at every stage of production

The fundamental expectation from the university-industry cooperation is the creation of added value to be able to be competitive in the global market. In order to be able to conduct the necessary works for this field, the industry must produce the technologies it is utilizing, and the information that is produced by the universities must be transferred to the companies in a way that is applicable in the R&D activities of the general industry (Yücel, 1997).

2.3.4 **Information transfer tools in university-industry cooperation**

Information transfers carried out between the universities and the industry are realized through interfaces. Kiper et al. defined the terms 'technology transfer' briefly as "transferring the scientific inventions or discoveries from one institution or environment to another in order to advance or commercialize these inventions or discoveries." It is also stated by these scholars that creating marketing and commercializing strategies such as "defining the framework of the

technology to be transferred, protecting this technology by methods such as patent, etc. and licencing and establishing start-up companies in order to facilitate industrial usage" in the process of commercialization is critical (Kiper, Küçükçınar, & A.Hakan Özdemir, 2010).

Kiper states that universities cannot give the necessary importance to their main functions, which are education and fundamental research studies, if they focus on commercialization; they will orient themselves to their commercial potential because of economic concerns, they will not be able to take care of the social issues and as there will be economic pressures, the possibility of focusing and working more on the commercial opportunities will put the scientists and the universities' autonomy and liberty of studying under great pressure. Regardless of these concerns, it is also frequently stated that there is a need for providing information transfer from universities to the industry, contributing to the R&D studies of the companies which are competitive in global field, and creating added value to the country's economy.

Within this context, university interfaces appear as departments working for decreasing concerns in the information transfer between the universities and the industry. Kiper ranks the reasons behind the needs for the technology transfer interfaces in the transferring of information to the industry as below:

• The recognition of the inventions made within their body and the prestige they gain,

• attracting and retaining valuable scientists,

• Rapport with the increasing national and regional rules and expectations in line with this,

• contributing to the national and regional economic development,

• benefiting from the funds supporting the cooperation at maximum level,

• The financing of more and advanced researches by the commercialized inventions" (Kiper, Küçükçınar, & A.Hakan Özdemir, 2010).

Kiper and his colleagues state that there is a need for the interfaces in order to found cooperation, and transfer information correctly and uninterruptedly, as there are differences in

the duties and priorities of the universities and the industry. The purposes of the interfaces are stated in the Metutech-TTO site as below:

"• Putting the academicians' scientific studies into the service of the needy sectors,

• Not limiting the Academic Knowledge only with the "scientific publications" and bringing it a "commercial value",

• Financing for the continuation of the university researches with the commercial incomes coming from the serving of "commercial value" to the industry,

• Academicians' reaching up to the financial satisfaction they deserve thanks to the products they generate,

• Supporting academicians in their aspirations to become entrepreneurs by establishing "spin-offs",

• Providing the scientific studies needed by the industry not from the foreign countries, but from our own universities,

• Increasing the number of patents and decreasing the cases of invention disclosures to protect the intellectual property rights,

• Being a university which is preferred by the academicians (thanks to a successful 'Technology Transfer Interface" posessed by the university),

• Drawing up a future with broad horizon for the students who want to be academicians; retrieving the brain drain" (Kiper, Küçükçınar & A.Hakan Özdemir, 2010).

2.3.5 **Duties and responsibilities of the state in the university-industry cooperation**

The settling of the knowledge-based economy on the technology in the globalizing market, which is explicated in the economy section of this study, increased the importance of

information transfer; and the view that information transfer is being carried out only via the universities and the industry is not sufficient is existent in the literature.

Kiper asserts that technology is not necessarily a pre-requisite for the sector competition, but it is also important for the measuring of the development level and efficiency of the country. Kiper further states that it is not possible to determine whether technologies are rapport and use these technologies efficiently and commonly in real time only with company strategies; it is necessary to determine national policies for that (Kiper, Küçükçınar, & A.Hakan Özdemir, 2010).

It has been emphasized that it is necessary to internalize the technology and create the necessary conditions for generating the country's own technology in order to be able to compete in the international market. One of the methods of creating the necessary conditions for that is the technology transfer and placing the transfer into the legal framework conveniently; hereby success can be achieved. It is accentuated that countries must produce their own technology by creating development strategies in order to be able to have a voice in the global competitive environment.

Yücel utters that states shall renew their industrial technologies when arranging their development policies, increase their capabilities of producing technology with policy tools, and allow for the structuring that will prioritize national industry in the imports and tenders. In addition to that, it is also accentuated that one of the pre-requisites is to produce policies that will maintain the stability in the country's economy (Yücel, 1997). It is important to finance and support researches with state funds in the university-industry cooperation (for universities and companies); arrange the legal regulations for this financing; make regulations in the tax system and regulate and put into force the intellectual property rights. In addition, the state undertakes the role of taking the necessary legal precautions to prevent the possible conflicts between institutions by determining incentive legitimate regional policies and encouraging

stability. Besides that; determining technology policies, designing geographical (regional spaces) places for the university-industry cooperation, and contributing to the creation of "economic ecology" and "innovation ecology" are among the factors that shall be undertaken by the state in the university-industry-state cooperation. Smith remarks that states may positively intervene in the research activities that are to be carried out in the institutions' autonomous structure, as an authority (Smith & Bagchi-Sen, 2010).

Göker states in reference to List's innovation model that the universities shall be responsible for the production of information and carrying out the necessary research activities in the innovation process; and the industry is responsible for the conversion of the information produced by the universities into advantage (developing a commercial product); and the state is responsible for providing the necessary conditions for the interoperation of these two institutions. Along with that, Göker also states that "the deficits in the investments and activities in the field of R&D showing up when the free market forces fail to provide the necessary capital for the scientific and technological advancement will be met by the state through public research institutions or public finances that will be founded" (Göker, 2000).

2.4 **Triple Helix Model in the University-Industry-State Cooperation**

The concept of innovation will be defined on the basis of the Triple Helix Collaboration in the university-industry-state cooperation and the relevant model's connection with the innovation ecosystem will be explored in this section. For this reason, the concept of innovation and its variances, along with the elements constituting the innovation ecosystem will be expressed, and the impact of the "Triple Helix Cooperation" on the R&D and entrepreneurship will be scrutinized in the fourth section. In addition, the subject of Intellectual Property Rights will be examined in this section as well, and thereby, the literature review will be terminated at the end of the section.

2.4.1 **R&D in Turkey and around the world**

In order to be able to define R&D, first of all; the question "What is research and development?" must be provided with an answer, and to deepen the definition, the history of the R&D activities will be scrutinized in this section.

In this context, Çiğdem Kavak defines the term research in reference to Öğüt as "scientific and technological activities conducted to be able to understand and learn about what is not known" (Kavak, 2012).

Özsağır defines the term R&D as; "R&D is transferring the individual and societal information, and it encompasses creative works based on a systematic foundation in order for facilitating the transformation of the relevant knowledge into new applications and practices" (Özsağır, 2007).

Zerrenler et al., on the other hand, define the R&D as "systematic and creative works oriented towards the production of new commodities and production processes in companies". R&D is the regular studies conducted for acquiring new information or improving the existent information to facilitate the development in science and technology. The aforementioned writers further state that R&D is an organized set of studies, which are oriented towards product or process innovation or increasing scientific knowledge (Zerenler, 2007).

R&D definition of the Frascati Manual guide is indicated; "Research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications" (TÜBİTAK,2002).

Departing from the above definitions, in order to explicate an activity of research and development as R&D; the activity must be systematic, it should be carried out on regular basis for the innovation of products and processes, taxes must be collected, and analysis must be carried out through right methods.

As speed has gained importance in almost all fields in the 20th and 21st centuries, conducting R&D studies and activities on regular basis has become an obligation in order to be able to take place in the world competition, comply with the changes, and create innovations.

Zerenler et al. stated that "The technological information comes out as a result of the R&D activities, and prevails in the entire economy, and as a consequence, economic growth takes place. The R&D studies are namely the struggle for existence for the businesses in today's world, in which there are harsh and cruel conditions for competition" (Zerenler, 2007). The writers emphasize the importance of R&D studies as such, and also state that the economy cannot advance without an infrastructure of R&D.

In this context, Zerenler et al. determine the purposes of the R&D studies as "developing new products and processes, finding areas for using existent and new products and commodities, finding new production techniques or improving the existent production techniques, reducing the production costs by catching up with the developments in the competitor companies, improving the relations between the employers and employees, and establishing the right management and information systems that will facilitate the transfer of the necessary and right information to the management on time" (Zerenler, 2007).

The activities shown in line with the R&D purposes are of great significance. Kavak identifies the R&D activities as below:

- "Acquiring new technical information that will facilitate new scientific and technical/technological development in order to be able to enlighten the uncertainties in the fields of science and technology,
- Researching and developing new methods, processes and procedures oriented towards production,
- Developing new methodologies or producing new techniques to create new products, materials, tools, devices, processes, and systems,

- And software activities based on original designs" (Kavak, 2012).

In order to transfer the R&D information, accessed through scientific approach in the activity fields indicated by Kavak, to the industry and create added value, "etudes must be carried out to examine the concept development and technological/technical and economic feasibilities, laboratories must be used in the transition process of these concepts to the designation, prototypes must be produced, pilot premises must be found, trial productions and type premises must be founded, and the problems arising after sales must be solved" in all the R&D activities (Kavak, 2012).

The R&D types are divided fundamentally in three, as the fundamental research, practical research, and experimental development ones. The fundamental research results in the product design are in fact, defined by Zerenler and Devrez as "a scientific struggle which aims to actualize principles of science and technology, instead of having a commercial purpose, and broaden the borders of the science". In the same source, practical research is defined in reference to Eren as "contributing tangibly to the existent scientific and information and principles to solve certain specific problems with a commercial or practical aspire, and improving the important practices in the researches that are conducted to this end" (Zerenler, 2007). Tekin claims that practical researches can be used more tangibly in the industry that the fundamental researches and they can give more tangible results than the fundamental researches. (Tekin, 1996).

Types of improvement are determined as "the state of transforming the fundamental and practical research results into new models, products, or outputs in each type" (Barutçugil, 1981). According to Kavak; "the improvement and development function in the businesses is explained as using the fundamental and practical research results in creating any kind of beneficial material, tool, product, system, and product management system; or improving the

existent fields in this sense" (Kavak, 2012). Having said that, the aforementioned writer broadens the definition to incorporate more fields.

The outputs such as product, service, and the beneficial model emerging as a result of the R&D studies, serve to the fundamental situation, which is; "Innovation". The competitive advantage of the companies in today's conditions can be plausible depending on whether they are the leaders or followers in their field of activity, and this is determined by their difference in the products and services they provide. It is necessary to comprehend the importance of R&D studies for being able to differentiate from the others and acquiring new products or outputs.

2.4.2 **Intellectual property rights**

Intellectual rights can be defined as the rights which aim to protect the intellectual works and their outputs through the government authority (Soyak, 2005). They are seen as a factor encouraging innovation. According to the OECD, the regulation for protection of intellectual rights is stated to be a system which encourages the inventors and facilitates production of new technologies, innovation, and prevalence of technology to the general welfare of the society, and this system rewards the technology producers (OECD, 1997).

Soyak, who says that the history of the intellectual rights dates back to the 15th century, the Western countries established their industrialization and technological advancement with the inventions in the 19th century, and started to go outside their national borders thanks to the technology; and in this time period, the international organizations started to come to being, and this is corresponding to the early 20th century (Soyak, 2005).

In the OECD report, it emphasized that the government must continue to protect the intellectual developments when constituting a regime for intellectual rights; and these rights must be applied equally for the business partners, and it is also obliged to take the duty of facilitating access to knowledge and prevalence of technology (OECD, 1997).

2.4.3 **Definition of innovation and innovation types**

The fact that companies have to renew and improve their products and ways of conducting business, and create difference in the market condition in order to survive in the global market has paved the way for the obligation to innovate. Therefore, it is vital to understand what innovation is and define the innovation environment.

Elçi et al. propounded that the word innovation derives from the Latin 'innovatus' and the original meaning of the word is "starting to use new methods in social, cultural, and administrative environment"; they also mention about another definition: "Webster defines innovation as 'a new and different result', being slightly different from theirs" (Elçi, Karataylı, & Karaata, 2008).

It has been in the literature that innovation is not a new concept, and it was first defined by Schumpeter as "the propellant of development" in 1911. Elçi defines innovation by giving reference to Schumpeter as "the launching of a product, which is unknown to the customers, or a new feature of a product to the market; starting to apply a new production method; opening a new market; finding a new source for supplying the raw materials or semi-manufactured goods; having a new organization as an industry branch." A definition was made by Peter F. Drucker in the same source as such: "innovation is the equipment process with new, developing abilities or increasing practicality". It is also stated by Drucker that innovation should be oriented towards the market; and in case it remains being product-oriented, it will be nothing more than a "technological miracle" which is not capable of taking the expected advantages. In addition, it is clearly expressed that Drucker attracts attention to the issue of creating value, establishing innovation's difference from renewal (Elçi, Karataylı, & Karaata, 2008).

Göker, on the other hand, claims that the concept of innovation indicates both the process and the result; and that this concept is defined in the EU and OECD literature as "the conversion of an idea into a marketable product or service, a new or modified production or distribution

method, or a new social service method." In addition to these, it is also uttered in various circles that the word innovation covers the marketable transformed product, method, or service. Considering the current age, the word innovation means "transforming science and technology into economic or social advantage" (Göker, 7-8 Kasım 2001).

Trott mentions about the fact that although innovation is dependent on inventions, it has to commercialize in order to contribute to the growth of an organization and depending on this fact, innovation needs to cover all the production or marketing processes and equipment from the management of activities in the process of creating ideas to technological development. Innovation according Trott is; "application of an idea successfully to a company or organization" (Trott, 2005, s. 15-16).

The Oslo Guide defines innovation as such: "innovation or renewal is a new or considerably changed product (commodity or service) or service, application of a new marketing or organizational method in business practices, workplace organizations or external relations; whereby its transformation to economic and social advantage" (Oslo Kılavuzu, 2005).

It is possible to divide the innovation types into four categories as "Product Innovation, Process Innovation, Marketing Innovation, and Service Innovation" on the basis of the Oslo Guide.

"1. Product Innovation: This is the launching of a new or considerably changed/advanced commodity or service in terms of usage objectives into the market. This encompasses important amendments/enhancements in technical properties, parts and materials, firmware, ease of use or other functional properties.

2. Process Innovation: This is the application of new or considerably improved/enhanced method of production or distribution. This encompasses important changes in the equipment and/or software.

3. *Marketing Innovation:* This is the application of a new marketing method which incorporates major changes in product design or packaging, product placement, product promotion or pricing.

4. Organizational Innovation: This is the application of a new organizational method in the company's business practices, workplace organization or external relations" (Elçi, Karataylı, & Karaata, 2008).

Trott stresses that organizational and executive innovations always accompany the technological innovations. Therefore, he underlines the fact that ambiguous definitions expand the definition of innovation; innovation is at the center of all companies; and it can also be present in the product, process, and marketing. It is understood from this point of view that there is not much difference between Trott's innovation types and the ones identified in the Oslo Guide, and this fact is demonstrated in table in which Trott's types and examples are exhibited (Trott, 2005). Trott's innovation types and examples are shown in the Table 5 below:

Table 5: Type of Innovation and Examples

Type of innovation	*Example*
Product innovation	The development of a new or improved product
Process innovation	The development of a new manufacturing process such as Pilkington's float glass process
Organisational innovation	A new venture division; a new internal communication system; introduction of a new accounting procedure
Management innovation	TQM (total quality management) systems; BPR (business process re-engineering); introduction of SAPR3*
Production innovation	Quality circles; just-in-time (JIT) manufacturing system; new production planning software, e.g. MRP II; new inspection system
Commercial/marketing innovation	New financing arrangements; new sales approach, e.g. direct marketing
Service innovation	Internet-based financial services

SAP is a German software firm and R3 is an Enterprise Resource Planning (ERP) product.

Note: **(***Trott, 2005***).**

It is also possible to divide innovation into two as technological and non-technological innovations, according to the Oslo Guide and definitions in the literature. Technological innovation covers the product and process innovation; and non-technological innovation covers marketing and organizational innovation.

While the fundamental principle in the technological innovation is finding new technological ways for a new production and process; the fundamental principles of the non-technological innovation incorporates new ideas and renewals oriented towards the organizational structures and marketing strategies of companies. Notwithstanding this division, it is necessary for all the works in each and every field to support or complete each other in order to be able to create a value by innovation.

As understood from the definitions, in order to define an idea or invention as innovation, it is not necessarily sufficient for that idea or invention to be new or improved; it is necessary to create value.

In addition, Elçi et al. stated that social innovation and eco-innovation are also important in the facilitation of innovation; "*Social Innovation* is not just an economic system; it is, at the same time, a social system that removes the inequalities, creates employment and contributes to the protection of environment. "Social innovation is clarified as the development and implementation of renewing, changing, and improving activities that would avail all fractions of the society (Elçi, Karataylı, & Karaata, 2008).

Eco-innovation is identified by Elçi et al. as "developing products, services and processes designed to meet human needs, and provide everyone with a higher life quality with the minimum usage of natural sources per unit and minimum emission of toxic substances (Elçi, Karataylı, & Karaata, 2008).

In addition, classifications as *'Radical Innovation'* and *'Incremental Innovation'* are made, considering the content and effect size of the innovation. If innovation reveals products or

services which create radical changes in human life, it is expressed as *'Radical Innovation'*. *'Incremental Innovation'*, on the other hand, is defined as acquiring novelty as a result of a gradually growing work emanating to the process (Elçi, Karataylı, & Karaata, 2008).

Business Model Innovation, Organizational Innovation and *Marketing Innovation* are among the non-technological innovation models classified according to the processes. In addition to these types, *Cross Innovation* is also mentioned. Kiper explicates the cross innovation, which is also called as *Technology Fusion*, as such: "As a type of innovation, *'technology fusion'* means that two or more known technologies produce an innovation that leads the brand new function(s) that allow progress, as 'hybrid technology'; a known technology in a sector encompasses its fusion to another sector, as well" (Kiper, 2009).

Trott draws attention to the fact that innovation is dependent upon inventions, but the inventions must be commercialized in order to be able to contribute to the development of an organization/company. He further states that starting from the management of all the activities in the beginning of the process, innovation includes developing technologies, works of new production and marketing, the process or equipment of improved product or production (Trott, 2005).

Except for the definition and types of innovation the models and strategies of innovation are significant, as well. Strategies and innovation mechanisms will be discussed in the next sub-heading.

2.4.4 **Innovation models and strategies**

It is stated that the approaches to innovation differ depending the region, yet the Mode I, Mode II, Triple Helix, and Cluster approaches come to the forefront in the literature.

Taylan mentions that the Mode I approach is an old concept, and there is a sharp difference between the academy and society in this approach. Accordingly, it is observed that the academy

takes place around the “scientific disciplines and specialties that defined within them”. And no relationship was observed between the universities and the industry.

The Mode II approach, differently from the Mode I, has an interdisciplinary structure. In this model, the findings acquired from the scientific studies are regularly transferred to the expert teams in order to allow them to deal with the short-term problems or let them form clusters by determining the priorities in social and economic problems; and thereby, interdisciplinary studies are carried out.

Taylan et al. explicate in reference to Porter that the cluster model “is composed of geographically close company groups, suppliers and relevant organizations (such as universities), which are dependent on one another with various types of external relations in a certain sector”. Clusters provide advantage in economic and competitive performance, and play an important role in the creation of regional economies, as well. Taylan et al. scrutinized the University-Industry-State cooperation for the Triple Helix model, and emphasized that “universities will play a vital role in innovation” (Taylan & Ünsan, 2009).

Işık and Kılıç, on the other hand, propounded that the innovation system approach can be examined in narrow and broad senses in terms of content; the narrow sense reflects the linear model, as determined by Cooke et al.; and this is qualified as “the triple helix approach which combines the R&D functions of the universities, public institutions and research institutes of the private sector”; the broad sense, on the other hand, is stated to incorporate “learning, divisions and directions” (Işık & Kılınç, 2012).

Trott determined the types of models as Linear Models, Simultaneous Coupling Model, Interactive Model, and Network Model (Trott, 2005). These models will be scrutinized in accordance with Trott as below. The chronology of the innovation models which has been developed up until today are demonstrated in Table 6:

Table 6: ***The chronological development of models of innovation***

Date	Model	Characteristics
1950/60's	Technology push	Simple linear sequential process; emphasis on R&D; the market is a recipient of the fruits of R&D
1970's	Market pull	Simple linear sequential process; emphasis on marketing; the market is the source for directing R&D; R&D has a reactive role
1980's	Coupling model	Emphasis on integrating R&D and marketing
1980/90's	Interactive model	Combinations of push and pull
2000's	Network model	Emphasis on knowledge accumulation and external linkages

Note: (Trott, 2005), *(Source*: Based on R. Rothwell (1992) 'Successful industrial innovation: critical factors for the 1990s', *R&D Management*, Vol. 22, No. 3, 221–239.)

2.4.4.1 **Linear model**

Trott underlines the fact that this model was defended by the American economists after the World War II and that this model, which is comprehended simply, had been dominant for forty years. It is observed that the schools of management throughout the world tackled this model seriously in 1980s. In this model, innovation is constituted through university-industry collaboration on the basis of scientific interaction; technological development and needs of the market were shaped on the basis of a structure dominated by the industry. The interaction structure of those actions laid the foundations of the models which are in use today and the clarification of this model as regards to its conceptual structure is provided in Figure 4 (Trott, 2005, s. 23).

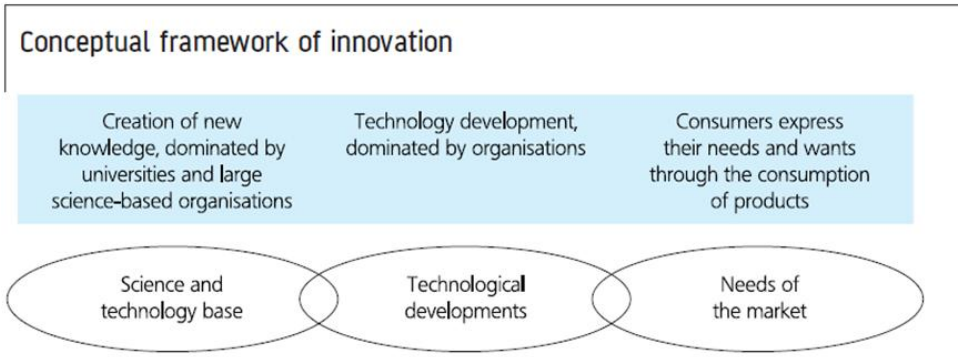


Figure 4: *Conceptual Framework of Innovation (Trott, 2005, s. 23)*

Innovation covers a process of a number of activities. Within this context, the linear innovation is traditionally divided into two fundamental types of innovations, as the technology propulsion (technology-oriented) and market traction (market-oriented). In the technology propulsion model, scientists make unexpected explorations, ideas of products are improved in a way that will allow technology experts to realize them, and engineers and designers test the prototypes of the products to be produced. The marketing and sales team, on the other hand, undertakes the function to promote the product to the potential customers. This type of the linear model found a field of practice after the 2nd World War, yet it is observed that innovation did took different tracks under certain circumstances in definite sectors and a new model, which sustains its validity, was created. This model is the market traction model.

Product development is carried out by utilizing customer relations and interactions effectively, and taking customer needs into consideration into consideration in the market traction model. The ideas produced as a result of the customer researches are sent to the R & D department and product manufacture is carried out after these ideas are improved in the R & D department (Trott, 2005). The structural difference of the two models is demonstrated in figure 5.

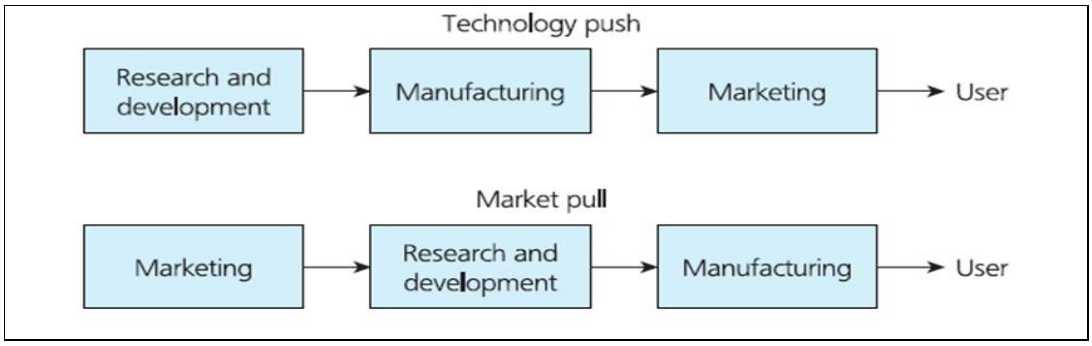


Figure 5: *Technology Push Model* **(Trott, 2005, s. 23)**

2.4.4.2 **Simultaneous coupling model**

People who are responsible for carrying out innovation sometimes fail to notice factors in relation to technology, customer needs, manufacturing, competition or other aspects. The linear model is just a triggering starting point for the ideas and needs, and it is able to present an explanation as to the place where the trigger at the beginning of the process lies. Figure 6 demonstrates that information is acquired as a result of simultaneous coupling in all the three functions that will encourage innovation of the simultaneous coupling model. Furthermore, the starting point of innovation is not known (Trott, 2005).

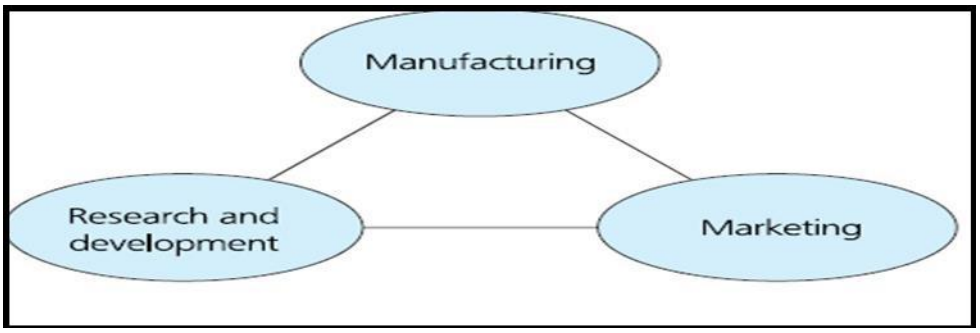


Figure 6: *The simultaneous coupling model* **(Trott, 2005, s. 24)**

2.4.4.3 **Interactive model**

According to Trott, *the Interactive Model* was developed as a model in which the technology propulsion and market traction models are utilized together. It has been propounded that this structure came out as a result of the interaction of the organization's abilities on the basis of information, and that there was not clear starting point. In addition, information flow is used for innovation, as well as for explicating how innovations and reforms are formed. Even if innovation is in a simplified structure, information flows show up in a number of different ways, and it is stated that they are quite comprehensive in terms of the innovation process. A logical ranking is necessary for sustainability, and there shall be feedbacks from and interaction with the separate processes and interactive factors with connected stages. It may well be deduced that information is transferred through a series of complex methods of communication

in the general innovation process. These methods include the internal and external connections. The innovation processes summarized in Figure 7 represent the organizational abilities and connections via the market and fundamental science approach.

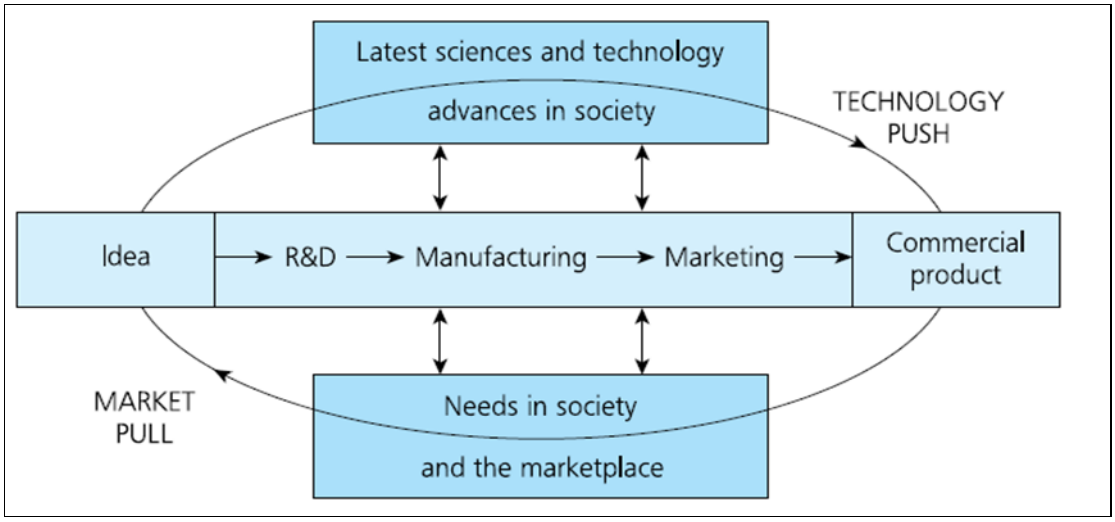


Figure 7: *Interactive model of innovation Source: Adapted from B. Rothwell and W. Zegveld (1985) Reindustrialisation and Technology, Longman, London. (Trott, 2005, s.25)*

Engineering, design, production, marketing, sales, R&D, and organizational functions are at the center of this model. This may seem as a linear model at first sight, yet the communication model is not linear, and feedback is a necessity. Moreover, it is constituted through the all functions with fundamental science, market, R&D, or marketing. Trot says that there are three compounds of producing information in this model, and these are: organizational abilities, market needs, and the scientific and technological infrastructure (Trott, 2005).

2.4.4.4 **Network model**

Trott gives reference to, Nonaka and Kennedy and utters that they defined innovation as a process of creating information coming to view as a result of social interaction, and this interaction takes form within formal and informal framework. This interaction is stated to create opportunities for the potential ideas and opinions, and trigger information sharing and change,

as well. It is difficult to express theoretically the information about actions, which are known, but not clarified as normal, and this information is identified as “Tacit Knowledge”. The most important feature of such kind of information is the fact that it is acquired through implementation that takes place step by step during conducting the work, and action and experience-oriented transformations. The fact that this information composes the relevant know-how is also among the most important features of such kind of information. It is asserted that internal and external interaction, developing industrial and data-processing abilities by taking the company capacity into consideration, and creating a research structure in line with this is necessary in order to create innovation in the Network Model. Furthermore, when a company advances through innovation, it is asserted that it is impossible for that company to go backwards. The frame of mind of the Network Model is presented in Figure. 8 (Trott, 2005).

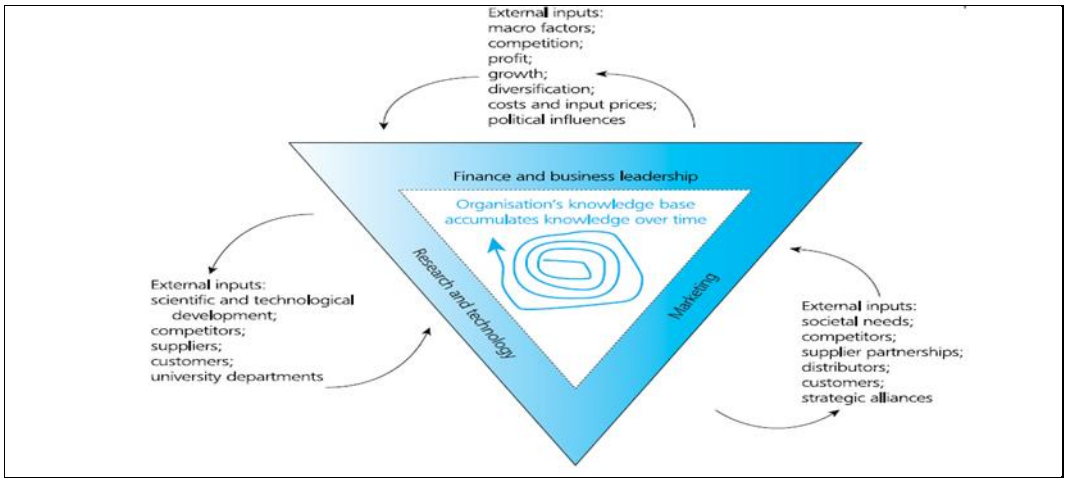


Figure 8: *Innovation as a management process* **(Trott, 2005)**

The importance of the interaction and communication between the functions inside and outside the organization is emphasized in Figure 8. The lateral communication style of the Network Model helps the personnel, working under executives, reveal their creativity. This emphasizes the importance of formal and informal network in all the functions. This situation on the one hand, creates a need for varience, and on the other hand, causes tension between new networks and relations. It also paves the way for bringing common features into forefront in order to

facilitate efficient internal communication. In other words, the individuals are declared to make a personal preference among the information variance and common features. Thus, the variance and information partnership among individuals may well create an organizational conflict (Trott, 2005).

2.4.5 **Innovation Strategies and Systems**

The developing process of the innovation eco-system shapes on the idea in literature that there is a transformation from the local to globalizing systems. This transformation is accounted by Erkal as "*A transformation that came into play in the 1980s; and revealed itself as a radical transformation that led the processes extending from local to national, and from national to global, to be globally impactful*" (Erkan & Erkan, 1993).

It is also in the literature that social and technological developments are effective in this process, which goes from local to global. Erkan (2007) states that the commencement of the process dates back to the *Mitos and Logos*, which indicates starting to comprehend and explicate events through reason in the ancient Aegean civilizations, and then the process grew away from the theological explanations of the Medieval Age thanks to the concepts of "*humanism, reformation, enlightenment, and positivism"* in the period of Renaissance, and a new process of "*endeavouring to explain the nature and universe through exploring and understanding whereby reason*" entered into force and this, in turn, paved the way for the Industrial Revolution. Erkan (2007) stated that the quantum theory brought about a new point of view to the understanding of universe in later periods, and this approach adopted "*uncertainty* and *possibility* instead of the *certainty* and *absoluteness* principle; a system composed of *mutual - interactive multi interaction, instead of unidirectional causality*; and structure formed by the interaction system instead of the objective reality". The system that is created through this approach can be named as embedded network integration paradigm, as declared by Erkan (Erkan & Erkan, 2007). Although it involves a partial contradiction and

chaotic structure, the structure which, is defined as the embedded network integration paradigm, is stated to be able to *"simultaneously involve the effects of different platforms, -rather than a single platform-, time, space, and environment factors"* as it has the power to create a mutual interaction thanks to the positive and negative synergy it creates (Erkan & Erkan, 2007). It can be deduced that this paradigm carried humanity from being an "Industrial Society" to today's "Information Society" and new concepts and strategies has come out during the course of this transition. Erkan determines that the concepts of *"Sustainable Development"* and *"Humanitarian Development"* entered into the literature through a World Bank Report. **"***New intrinsic growth models"* were developed by internalizing the technical innovations acquired as external data in the development models, where production function analyses are conducted (Romer 1996, Minford-Peel 2002, Salvotare 200, quoted by Erkan & Erkan, 1993).

Elçi, Karataylı & Karaata (2008) claim that "innovation in a country can be realized through the fact that actors such as public institutions, private sector organizations, universities, research institutions – which constitute a network – are in a state of interactive communication" (Elçi, Karataylı, & Karaata, 2008).

Aykut Göker (2001) says that the innovation competency is not just involving the ability to transform science and technology into economic or social advantage, it is dependent on whether science and technology is produced within the relevant country. In addition, Göker asserts in reference to the Industrial Research Institute's report that the production skills depend on three demands: first of these demands is related to 'technological innovation', the second one is related to 'reforming the economic climate in order to allow the private sector carry out innovations and sustain its competitive capacity', and the last one is related to 'sustaining the state's powerful role in supporting universities, which are targeting at advancing the level of knowledge in humanities in science, and engineering' (Göker, 7-8 Kasım 2001).

Departing from the aforementioned information; it is uttered that innovation culture and innovation climate has to be created in order to make innovation. What is meant by the innovation culture is the fact that the private sector organizations, research institutions, universities, and the state shall be responsible, and create an environment that supports creativeness and collaboration. Creation of such an environment, on the other hand, will facilitate national, regional and global innovation policies; and support innovation strategies.

Each and every country's internal and external dynamics and cultural infrastructure caused variance in their innovation strategies, and it is accepted in the literature that countries have different strategies because of this fact.

2.4.5.1 **Innovation strategies**

Innovation strategies are as important as innovation culture in making innovation. Zerenler (2007) states that the reason why innovation is perceived as a tool for growth is the need for sustainable innovation by companies. Innovation presents businesses a creative and energetic working environment and thus, creates new business opportunities; and meeting the demands of the market sufficiently will increase customer satisfaction. Furthermore, if the companies are not innovative; they will not conform with the conditions of the time and environment, their ability to change and adapt will decrease; as a result, they will lose their chance to exist and develop in the market, as proposed by Zerenler. Zerenler also claims that making innovation is important in terms of being able to comply with the new necessities and environmental conditions (Zerenler, 2007).

Within the same line, Satı and Işık stated in reference to Cormican & O'Sullġvan (2004) that strategy is an executive tool to take the peripheral changes or transformations under control in a competitive environment to facilitate the advancement of innovation and mutual compliance of the businesses to the environment. Satı and Işık (2012) said, "Strategy and leadership are the critical success factors in efficient innovation management. In the same way, it is not possible

for a company, which does not have an efficient strategy, to take the necessary steps for the innovation management (reformation management) (Cormican &O'Sullġvan, 2004: 819, quoted by Satı & Işık, 2012).

Michael E. Porter stated in his article, named as '*What is Strategy'* -which was published in 1996- that strategy protects companies by bringing them to a different point than their competitors, and strategies can provide companies with low price advantage or create a value chain, or carry out both these market solutions (Porter M. E., 1996).

After the systematic analysis of innovation, initiative plans oriented towards feature can be made; the process of developing strategy will start by monitoring consumer behaviours, competitors, and technological developments; and according to literature, all these will have an impact on the company strategies (Pınar, Kamaşak, Bulutlar, 2009 quoted by Satı & Işık, 2012 ve Porter,1996).

Zerenler asserted that there seven types of innovation strategies, which are *Assailant Innovation Strategy, Defensive Innovation Strategy, Imitator Strategy, Dependent Strategy, Traditional Strategy, Following up* and *Acquiring the Opportunities Strategy*. All these strategies will be explicated below on the basis of the resource.

Zerenler quoted Christopher Freeman, Halime Sarıhan, and Tekin saying that Assailant Strategy means being the leader of the market by getting technologically ahead of competitors and generating new products. Companies utilizing this strategy intensively conduct R&D studies. Small businesses except for the ones utilizing only a certain technological invention do not use this strategy. The companies using the Assailant Strategy are only focused on the R&D studies, and their strong technical premises are not sufficient. Besides all these, the structure of the information should be strong, human resources and senior management should be open to taking risks, and the intra-organizational communication should be at a good level. Moreover, the organizational structure must be flexible and facilitate learning, which is deemed important.

Businesses applying the *Defensive Strategy* do not make technological innovation; they rather try to advance the existent technology and benefiting from these existent technologies is far more important for them. Companies applying the defensive strategy value research as much as the companies applying the assailant strategy. The difference between the two strategies lies in the quality and timing of the innovation; the companies adopting this strategy do not want to lag behind the technological development, even if they do not have a claim to be market leader. It is frequently asserted that this strategy is generally preferred by the companies which do not want to pay the cost of the first innovation or face the problems that may arise in the application of the first innovation or invention. *Imitator Strategy* is used by companies which follow up the leaders of the settled technologies from distance, and which have low level of workforce, material, and energy; which work on the basis of the investment costs, and do not want to invest in the R&D studies. It is stated that the success of the companies adopting this strategy comes from their lower production costs than the other companies adopting other strategies. *Dependent Strategy* is a method implemented by companies functioning as a sub-organization of a strong firm in terms of technological innovation. They apply changes in the products they launch in the market on the basis of the customer demands. And the R&D studies, on the other hand are mostly conducted by the big capital-intensive companies they are bounded. The most important difference between the *Traditional Strategy* and *Dependent Strategy* is stated to derive from the qualification of the product. Zerenler stated that "Significant changes may rise depending on the fact that designs and product specifications are outsourced for the dependent company's product. Whenas, the company using the traditional strategy does not see any need for change in the market, without and demand for a change from the customer and a clear stimulant in the competitive conditions" (Zerenler, 2007). In addition to this, it is claimed that businesses which possess the traditional strategy do not have the scientific and technical capacity to make product innovation; and they conduct design changes just because it is

fashion. *Following up the Opportunities Strategy* is founded upon outclassing by increasing market share through analyzing the competitor's weak points, and utilizing the same technologic innovation, in which the competitor failed to use.

Acquiring the Opportunities Strategy, on the other hand, is a strategy founded upon making innovations as a result of the implementation of information concerning a technological innovation by the employees of a certain business; and benefiting from a technological innovation acquired from another enterprise's R&D investments with a low cost (Zerenler, 2007).

Satı and Işık mention about the necessity to determine the strategies, plan and implement the relevant projects, and locate the innovation environment / culture within the organization in order to sustain innovation (Satı & Işık, 2012). The way to strengthen the weak points to create innovation culture on global basis is declared by Satı & Işık to be creating convenient circumstances for the innovation culture to flourish. Satı and Işık said in reference to Berber that innovation management is a process that aims at creating value by assessing the business model as a whole. The directions and results of the strategic innovation (Sniukas, 2007: 24, quoted by Satı & Işık, 2012: 554) are demonstrated in Figure 9.

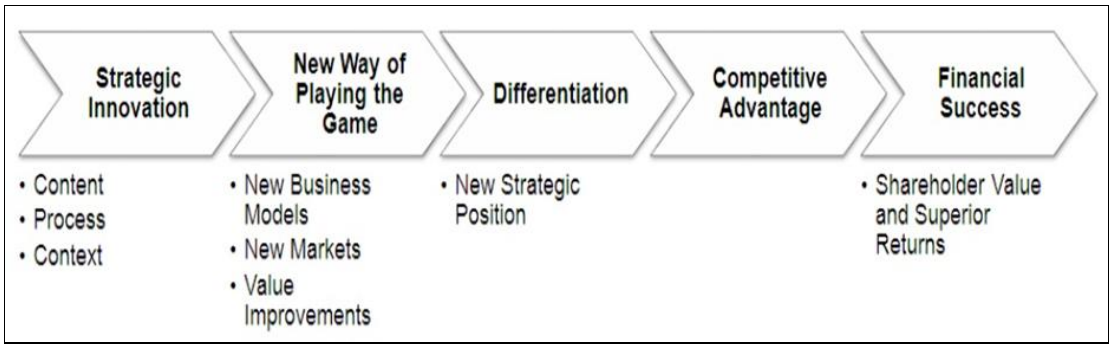


Figure 9: *Direction of Innovation Strategic and Results (Sniukas, 2007: 24, Satı & Işık, 2012: 554)*

Taking the Figure 9, which is shown above, into consideration; we can deduce that there are three types of strategic innovation; and these are: "new business models (new value chain

architecture), new markets (by creating new ones or reshaping the existent markets), and the increasing value for both the customer and company, or the combination of all these three types, is also relevant" (Satı & Işık, 2012).

2.4.5.2 *Innovation systems*

The origin of the innovation system approach (Tüylüoğlu & Saraç, 2012), is stated to be dating back to the economist Friedrich List's 'National Political Economy System' in 1841; and then Lundvall's "innovation system" which he scrutinized in 1985; and finally Christopher Freeman's definition of "national innovation system" in 1987. Tüylüoğlu & Saraç explained the concept which is named after the national innovation in the literature as "innovation in a country takes place thanks to the networks created by actors such as public institutions, private sector organizations, universities, and research institutes; and the interactive relations among these actors" (Tüylüoğlu & Saraç, 2012). The definitions of the National Innovation System used in the literature are presented in Table 7.

Table 7 ***The definitions of the National Innovation System***

AUTHOR	DESCRIPTION
Freeman (1987)	Activities and interactions initiated new technologies, import, modify, and create the institutions in the public and private sectors emits a network structure.
Lundvall (1992)	In the new and economically useful knowledge production, dissemination and use, and are the elements interact and relationships contained within a country's borders.
Nelson ve Rosenberg (1993)	Interaction of institutions that determine the innovative performance of national firms is the set
Edquist ve Lundvall (1993)	A national innovation system is created by the economic structures and institutions that influence the direction and rate of technological change in society.
Niosi vd. (1993)	A national innovation system; aimed at the production of science and technology within national borders private and public sector firms (both small as well as large companies), it is the system formed by the interaction of universities and government agencies. The purpose of the interaction between these units; The development of new science and technology, the protection is to be financed or organized. These interaction between units; technical, commercial, legal, social and financial might to complete.
Patel ve Pavitt (1994)	In a country, incentive structures and competencies, the rate and direction of technological learning (or change the volume and composition of the activities which) is a system consisting of determining the institution.
Metcalfe (1995)	The development and spread of new technologies to jointly and individually contribute which, while implementing policies to influence the innovation process and where different institutions providing a framework for management in the form of innovation It is whole. Such a system; information identifying new technologies, skills and artifacts create, save, and of interconnected institutions to transfer the system formed.
Galli ve Teubal (1997)	The establishment of a specific organization and institutions, scientific and technological knowledge production, the creation of the necessary links for diffusion and implementation.

Note**: "Resource: Feinson, 2003: 17 ve Peters, 2006: 20." (Tüylüoğlu & Saraç, 2012).**

Departing from the definitions in Table 7, the interaction of the main organizations in producing information, developing technology and creating an innovative environment draws attention. Within this context, Tüylüoğlu & Saraç quoted Soete et al. 2009: 17, and uttered that "education system is perceived as a part of the organizations and institutions cluster that forms the innovation system" and that "education system, specifically the universities aim at prevailing fundamental knowledge, upskilling students with technical and scientific abilities and encouraging research in laboratories; in addition, the national innovation system approach emphasizes the interaction between the universities and producer system and the U.S.A. has attained great success in triggering these kinds of collaboration." Moreover, the importance of the human capital and investment to R&D studies is also underlined (Tüylüoğlu & Saraç, 2012).

Göker (1998), on the other hand, states that it is possible to create national innovation system through forming a strong National Innovation Policy and thus, a National Innovation Culture in order to be able to compete in a globalizing world (Göker, 1998). With Asheim and Gertler's (2005) expression in the book prepared by the OECD, the innovation process gets affected by the relations between the organizations and actors, and the corporate infrastructure that supports innovation may well be expressed as the production infrastructure in this sense (OECD, 2010). Innovation system has a powerful spatial (geographical) property, yet the actors in the innovation system are not limited with national boundaries; they increasingly collaborate with foreign companies and organizations. At the same time, it is frequently claimed that the innovation performance, informative organizations, and research infrastructure within the country are not homogeneous, yet major regional differences are not allowed (OECD, 2010, s. 134-136).

Even though there are various discussions in the literature, the common definition for the regional innovation is accepted to be; the production, usage and proliferation of information for

the official institutions and private organizations, and making of efficient organizational and corporate regulations by taking public interest into account to this end. It is targeted to create social relations, norms, and values systematically in the society; and increase competitive power and capital by facilitating interaction between the regional firms through these networks in order to be able to realize regional innovation and strengthen the capacity for innovation (Doloreux & Parto, 2005). Doloreux & Parto stated that regional competitiveness is a productive system that annotates social and corporate conditions with concepts such as "learning region", "innovativeness environment" and "local industrial region". The regional innovation systems need to identify the interactions between especially users and producers, and interactions between businesses and larger research communities and different actors in the innovation process; these systems also need to find out where the necessary information to establish the corporate production systems in the innovation processes is embedded; evaluate the organizations' roles in this process; and scrutinize the trust factor to the policy-makers taking the operability of the regional innovation systems concept as a basis. Two main factors come into the forefront in the theory and research of regional innovation system; the first one of these is the innovation system, and the other one is the social institutions and environmental conditions that give rise to regional science and innovation. Considering the fact that companies making innovation are impacted by numerous factors, the first of the aforementioned factors incorporate a collective learning process in terms of the social aspect of innovation, interactions with foreign companies, collaborations, information providers, financing, and education. The second one, on the other hand, is determined on the basis of the methods to spread the locally produced information, regional rules and conditions. Consequently, regional innovation system; determines the cooperation between organizations such as universities, education institues, R&D institutes, technology transfer agencies and information spreading organizations; and in

time, contributes to the innovative structure of organizations by characterizing the innovation activities by supportive culture (Doloreux & Parto, 2005).

Just like Doloreux, Elçi also stresses that regional innovation strategies are developed on the basis of the special conditions of the relevant condition; and it is vital to improve the innovation potential of a region and increase its competitive power. Elçi determines the purposes of the relevant strategies as developing innovation culture by prioritizing innovation in the policies of regional governments, increasing the innovation activities of the private sector, developing cooperations that will contribute to the information flow between the university-public and business world by shaping the research-development activities of the business world in line with their own needs, contributing to the establishment of the necessary networks, and ultimately, contributing to the projects that will create enormous effect by using the resources allocated for innovation efficiently (Elçi, Karataylı, & Karaata, 2008).

One of the important factors in creating regional innovation strategies is the region's learning structure and industrial ecological structure; and whether it is close to the organizations providing information flow. Zhou stated that business environment and research institutions are important in terms of advanced technology clusters, and underlined the fact that innovation is realized through a number of face-to-face activities by engineers, entrepreneurs, and investors. Besides, according to Zhou, developing industry and cross industry, information networks, complex regional networks, and industrially diversified ecology will demolish the boundaries between the industries and contribute to the formation of radical innovation (Zhou, 2013). Isaksen (2001) utters that Porter (1998) sees territorialization as an important part of the globalization; different types of regional clusters have come to powerful positions as of 1970s; and these regional clusters have had important contributions to generating new products, providing competitive advatage, and creating added value (Isaksen, 2001). Cook, as well,

underlines that information is beyond being regional, it is globalized; social and regional tacit knowledge has got into global circulation (Cook, Boekholt, & Todtling, 2000).

Together with globalization, "the Triple Helix Model" has seen advancements in terms of knowledge transfer, which will be explicated in the next section of this study.

2.4.6 **Innovation tools**

In this section, the information transfer tools and information circulation models utilized in order to create innovation by the triple helix model and the development of civil rights and their field of use will be scrutinized on the basis of the literature.

2.4.6.1 **Knowledge transfer tools**

The mechanisms that are defined as technological transfer interfaces, as well, are expressed as information transfer mechanisms. Attraction was drawn to the efficient circulation of information via various tools, Techno Park, Techno City, globalization, clustering and international collaborations. Within this context, Kiper et al. defined the concept of technological transfer as "a set of processes which includes a range of interactions, such as information, experience and equipment flow between different shareholders like public, firms, financing organizations, research and development institutions, and civil society organizations (Mahmut Kiper, 2010).

Therefore, it has been in the literature that there is a clear need for an interface that will allow transfer between the institutions which conduct fundamental researches – information institutions, universities and research institutions – and industrial organizations which use and implement information. Techno parks have different applications, depending on the conditions of the region they exist. It is seen that those applications have been named differently as Techno parks, Center of Excellence, Incubator, Innovation Center, Entreprise Center, and Technology Development Center.

The definitions of Technology Park are similar to one another. Törel states in reference to Başer that the British Techno Parks Union is an enterprise affiliated with corporate bodies (Maltseva, 2010), universities or research centers constructed for developing technoparks and technology and producing global competitive industrial products; and this enterprise, the executive department of which endeavours to transfer the technology and industry skills to other companies, incorporates and encourages technology companies to grow and develop (Törel).

Kiper also underlined that fact that Techno Parks which are established within the university campuses or the vicinity are the most important tools that support new entrepreneurs of technology, and attracts the technological companies of incubators to the universities; saying "Techno Parks, which have significant contributions to the development of the university and even the region they exist, provide very much appropriate environments for the collaboration and interaction of numerous parties" (Kiper, Küçükçınar, & A.Hakan Özdemir, 2010).

The most important spheres of activity of the Techno Parks, the most significant example of which is stated to be the Silicon Valley among numerous examples all over the world, are determined by Shokin et. al (2012) in the Novosibirsk case of Russia. These spheres of activity are determined as developing companies which will be able to use the outcomes of the universities and scientific research institutions to develop technological products; contributing to the regional development by creating new job fields; developing the relations between universities and industry; establishing an education system to create innovation economy; commercializing intellectual properties, and contributing to the development of technology by creating business incubators (Shokin, Grishnyakov, & Bobrov, 2012).

In the study which was conducted by the Turkish Technology Development Foundation in January, 2012 to examine the Techno Parks within the scope of the model research for Turkey, it was determined that establishing technoparks, finding an original model for creating appropriate environments for Techno Parks, attracting large companies the relevant area by

facilitating collaboration between the organizations in the region, branding the region and creating a common regional vision are of great importance (Çakar, 2012).

Looking from the perspective of competitiveness along with the globalization; the development of the Information Communication Technologies in the 20th century, making innovations via the network structuring and with the impact of national and international cooperation, and contributing to the economy have been enormously mentioned in the literature. Within this context, the clustering approach, which takes place in Porter's (1990) diamond model, is expressed, in Porter's terms, as a community that increases the competitive power and collaboration, which is constituted by companies dwelling in the same geography and are capable of collaboration (Porter M. , 1990).

The general opinion in the literature is that the diamond model is fundamental in terms of network structuring, in particular, and entrepreneurship. With Porter's point of view, the structuring that starts on regional basis; provides competitive advantage through regional distances and increasing the functionality of information transfer mechanisms. Sayın stated in reference to Cook and Memedovic (2003) that the actors of the regional economy are "businesses, regional public authorities, universities and all the education institutions, collaboration organizations and civil society organizations, consultancy firms, technological development centers, Techno Parks, incubators and the national and international connections of all these entities" (Sayın & Sayın, 2012, quoting from Cook and Memedovic, 2003).

Departing from the above explanations, it is clear that national and international endeavours are not sufficient to create innovation. The national approaches are insufficient, as long as they are not integrated with network system. Thus, global competitiveness, economic developments on the basis of information and international connections can develop within the framework of the University – Industry – State cooperation.

Among the duties of the government or state are the initiatives, tax discounts and protection of intellectual rights. It is necessary to make regulations that will assure the fundamental infrastructure for entities, which support initiatives, such as spin-off companies for the product to be launched, product design, and the fundamental researches and opinions propounded by universities. The legal rights and examination of the patent rights will be provided in comparison in the analysis section of this study.

2.4.6.2 **The importance of property rights in the innovation system**

It has been observed that the property rights emerge in the commercial societies. Endeavors to protect innovations and discoveries were seen in Venice in 1443; and in the same way, the first patent and copy rights law was found in Venice in 19 March 1474. It was observed in certain resources that Britain was pioneering in legalizing, settling and developing the patent system. The first patent documents were found under the name of Letter Patent, and these documents served to the purpose of gaining time for the ones making an innovation to use technology. It has been stated that the way to patent law was opened in 1623 as the "British Monopoly Law" in Britain, as these relevant documents were violating the personal property rights. The Monopoly Law provided validity only for the relevant country with its patents, 14 years' time period and territoriality principle; and later on other countries adopted these principles, as well (Soyak, 2005).

The first tangible outcome of the R&D investments are observed to be the intellectual rights (patents, brand registration, etc.). It is emphasized that patents play a significant role in innovation and economic performance. Particularly, it is frequently stated that companies and public institutions have become dependent on patents and intellectual rights because of the globalizing and international network connections when looked from the perspective of the prevalence of innovation, ICT, biotechnology, and innovation processes. Notwithstanding that, it is emphasized in the OECD survey that companies are afraid that they will lose their

inventions and products to their competitors and as there will not be any confidentiality left, they are acting unwillingly to receive patents. As a result of this, the need for regulation in the patent regime was emphasized and it was uttered that the patent system shall be structured robustly in order to be able to prevent the copying with sanctions which will be regulated through legal procedures (OECD, 2004).

The South Korea Intellectual Patent System development encompasses three major periods of the IP system in the 1960s, 1970-1980 period and post 1980s. The significance of the regulation in 1960-1961; indicates the fact that the regulations in these years constituted an invention law similar to that of the USA, even though its protection function was weak, and it was revised in 1973 on the basis of the international innovation criteria. This regulation corresponds to the development of the technology market in the South Korea and in the same period, a patent agreement was made between Japan and South Korea. The intellectual rights agreement with the USA followed that, and South Korea became a member to WIPO in 1978. When it comes to the year 1980, South Korea's IP system was adapted to international systems; medicine, chemistry, computer software and equipment products were included within the scope of the patent protection in 1986-1987 and a fair competition environment was created. The IP courts concept was defined in 1998, and as a result of the regulations in these years, a major increase in the number of the patents in South Korea was observed. Throughout 2000s, the importance of university-industry cooperation was emphasized, and four new legal regulations being the Science-Technology Fundamental Law, Technology Transfer Incentive Law, Patent Law and Legal Industrial Education Promotion and Technology Transfer Incentive Law were launched. According to the law, universities can legally collaborate with the companies for information and technology usage to commercial ends (Lee). It can be uttered that South Korea determined its collaboration between university-industry-state through this article.

It is stated in the literature that Chinese intellectual rights and patent system developed in two separate periods. The first period was between 1800-1900s when China was trading actually and powerfully, and constituted the first intellectual rights strategy. This period started with the *Open Door Policy* and *Quadruplet Modernization* in the last quarter of the 1900s. The intellectual rights of China emerged in the first period in line with the foreign investments impact and demand; and a number of brand protection and commercial treaties were made with many countries such as the USA, Britain, and Japan. The patent system in China throughout 1800s contributed to the advancement of science and technology and the first patent law was regulated in 1898. Although the first patent law in Western sense was created in 1898, a failure was gone through in the Japanese-Chinese war (1894-1895). The USA and Britain put pressures on them to participate in the international agreements protecting the intellectual rights in the early 19th century. Incentives were started to orient China to participate in the Paris Commercial Treaty and Bern Literary and Artistic Agreement in the Yu period. In the second period of China, it was targeted to improve the industry, agriculture, national defense, science and technology with the Quadruplet Modernization and thereby, catch the economic success around the world. The method of rewarding mechanism to incite inventions and attract the investors and technology was utilized before this policy in 1978. Participation to WIPO in 1980 was another incenting method. It is seen that the property rights were legalized with the 5th General People's Congress in 1982 and Paris Covenant in 1984. The Patent Law's provisions accepted in 1984 started to be implemented; the legislation prepared to provide quality guarantee and advance the socialist market economy by protecting the reputation has not just protected production, but the rights of the brand owners and consumers (Stoianoff, 2012).

After the USA's independence, the provision to provide inventors with certain rights within a certain time to improve the beneficial technology and sciences was incorporated in their constitution of 1789; and under the British patent system's impact, the first patent law entered

into force in 1790. The first regulation to protect the commercial brands in the world took place in the mid-1800s according to the literature. There are intellectual property rights in the Paris Agreement, and provision of protection of artistic works in the Bern Agreement. In this context, not having provisions of protecting the ICT software, patent or copyrights developed in the 20th century in either of the agreements, and being able to copy the technological works easily created a necessity for new regulations. It has been stated that this issue was handled in the Uruguay Round for the first time and the above necessity was fulfilled in the TRIPS Agreement (Soyak, 2005). The significance of this agreement is the changes in the protection process of the copyrights. The agreement provides protection for 50 years of import and export including the computer programs and specific writings. Furthermore, the protection is valid without the country base when the product or process patent is on topic. In addition to that, the case of using the patent owner's work without his/her permission was regulated and payment for the patent of the works or products used without permission is made obligatory; and this was regulated in detail, the 10 years' procedure of protecting the patent was increased to 20 years starting from the documentation date (Soyak, 2005).

"The Ottoman Invention Acquittal Law", which was translated from the French Patent Law in 23 March 1879, protected its validity in Turkey until it was abolished in 1995. The Brand Registration Law, in the same way, entered into force in 1871, being translated from the French brand law "Regulation on the Trademarks Peculiar to Freight Commerce", and altered as the "Statuary Decree on the Protection of Industrial Designs" in 27 June 1995 (Soyak, 2005).

The countries need to tackle the intellectual rights legislations when creating their peculiar innovation models, which is a fundamental issue. In terms of the developing countries, they should develop their technological infrastructure on the basis of innovation and constitute their technological accumulations to provide intellectual right benefits nationwide. Leydesdorff explicated the three dimensional impact of the patents in figure 10.

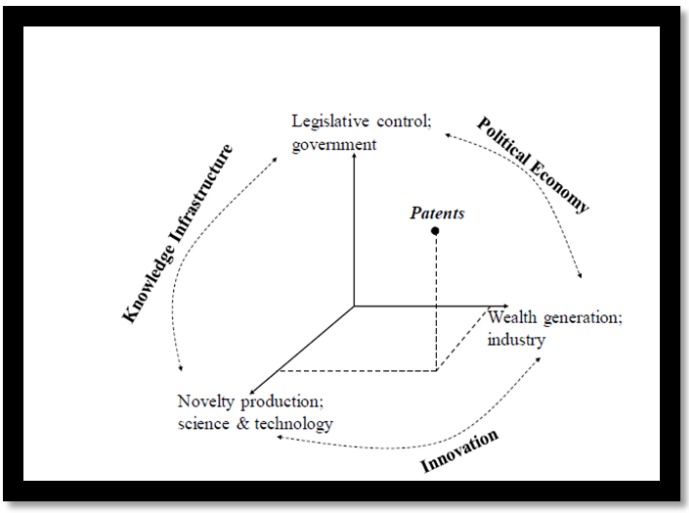


Figure 10: *Patents as events in the three-dimensional space of Triple Helix interactions*

(Source: Leydesdorff, 2010, Leydesdorff, 2012)

He asserts that patents are creating coordination with the academy, and the government creates industrial value through developing a control mechanism by legislations. In this sense, patents with scientific and technological outputs function as inputs within the economy. The contribution of the information based economy to the political economy is stated to be the organizational systems resulting from internalizing the information in the R&D studies (Leydesdorff, 2012).

OECD determines that patents increase the economic value, and that strong inventions support the innovation and solution alternatives in the patent system (OECD Report, 2005).

As a result, developing or less developed countries shall create their own information based economic models when determining their scientific, industrial, and technological policies. In order for this system operate smoothly, countries shall do the necessary regulations to protect the intellectual rights and constitute their own infrastructure accordingly, thereby they will create added value.

2.4.6.3 **The relation between innovation and R&D**

The relationship between the R&D and innovation is shaped through the internal growth theories propounded after the 1980s; it has been uttered that the origin of this relationship dates back to Schumpeter's technological internality theories. The theory which tries to explicate the developmental differences between the countries was mentioned in the first section the thesis. The relevant approach accepts the theory as an internal variable, and underlines the impact of the R&D activities on economic growth. It has been underlined in the literature that long term growth can be actualized through innovation, and the long term actualization of this will be facilitated by the R&D mechanisms. While it is stressed that R&D activities, producing the technology owning the intellectual property rights, impact efficiency; the long term procedure bears risks, as well (Yıldırım & Keskinoğlu, 2012). Fundamentally, the internal growth theory, in a sense, is connected to the technology and innovation created by the R&D activities and impacts the country's economy in a positive way.

The fact that expenditures for the R&D activities carry investment quality and the profit which will be acquired as a result of these investments will be higher than the R&D investment must be taken into consideration. When compared with the production methods acquired through technology development, the R&D investments produce meaningful results in companies at micro level, and country economy at macro level with the perspective of creating innovation.

The new techniques, procedure improvement, works to reduce the cost of production, creating new technologies and peculiar designs within the scope of the developing economic structures come to the forefront as activities creating added value in brand value and software products. The totality of these acts of creating value demonstrates the activities of economic, political and cultural developments in the society. Arranging and encouraging scientific and technological policies are of great importance in terms of development; it shall be known that investments in this field will create benefit in the long term.

The most obvious feature of the R&D investments is uttered to be the production of new information. The information for production, which is mentioned by Ağır (2010), encompasses innovation, invention and studies to turn these into economic benefits. Consecutively, when the new product/service emerging with the R&D studies conducted, domestic and foreign quality standards and consumer satisfaction are taken into consideration, the investments will create competitive advantage and it shall be known that the project will be finalized when an R&D project becomes marketable and provides advantage (Ağır, 2010).

Depending on the above scrutiny, R&D activities constitute an important part of the innovation in terms of their benefits in micro and macro levels. R&D activities bear importance as regards to competitiveness. Because of the countries' contribution to technological superiority and improvement of their existent technologies/service, it has a significant place in the innovative approaches. Furthermore, it is also important in terms of licensing the R&D activities, and innovation criteria within the context of intellectual property rights. Cooperation started to gain significance in the 20^{th} century for the improvement of R&D activities and production of new information. Information generated both in universities and market constitutes resource for these kinds of activities at the same time, and brings about change in the structuring of R&D activities through projects to find efficient ways to advance product development and marketing processes. Innovation monitoring and development have become important instruments in the development of R&D activities and innovation processes. No innovation can be successful without research and development activities. As a result, R&D investments are important parts of a country's innovation ecosystem.

3 ANALYSIS & EVALUATION

In the analysis section, the Global Innovation Index 2014 – which is a secondary data –, GII (Global Innovation Index) 2011.2012.2013 data, and relevant information from the OECD reports will be used for annual comparison. In addition to the GII data, data belonging to the Turkish Statistical Institute will be benefited from to study Turkey. A comparison and contrast will be carried out for U.S.A, and Germany, with Turkey - the countries that are among the first five in the Global Innovation Index 2014 indicators index - and South Korea and China with Turkey in terms of their resemblances R&D structure. The innovation structures and models of the abovementioned countries will be scrutinized, and on the basis of the results acquired from these evaluations; Turkey will be assessed and Turkey's analysis will be done according to the GII.

3.1 Analysis

3.1.1 Global innovation index indicators

In this section, analysis is carried out on the basis of the GII (The Global Innovation Index) 2014. Countries' R&D activities and development levels will be determined and charts providing comparison between their weak and strong points will be presented on the basis of 2014 index in this section, in which Global Innovation Index indicators and intended purpose and especially the importance of the index will be emphasized.

GII covers 143 country economies over the world and 81 indicators are used for assessment. Therefore, the index provides a rich data cluster for the assessment of global innovation tendencies. Each indicator includes detailed information about each country's economic resources and profile, annual index combination, indicator definitions and technical notes (Cornell University, 2014).

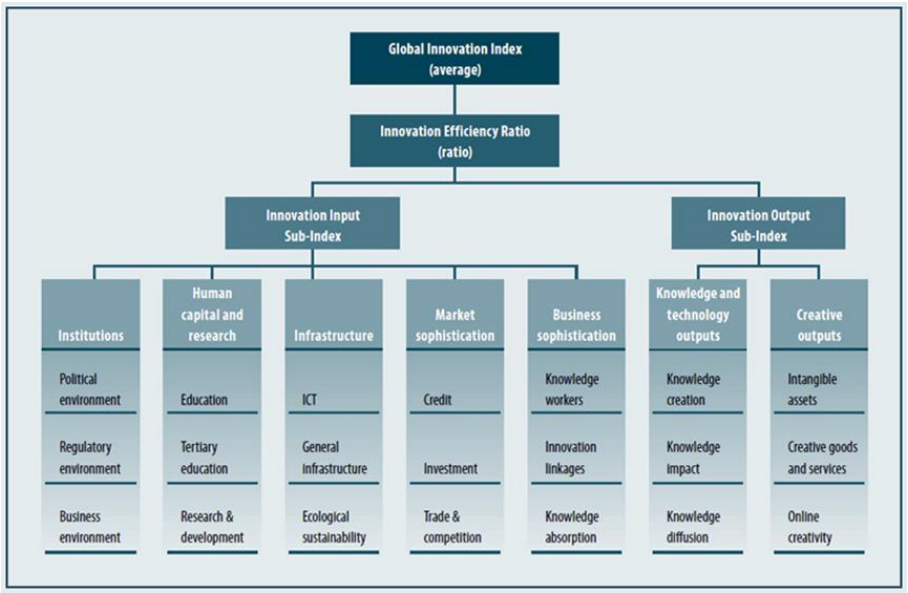
As can be seen from the chart in the addition, the innovation indexes of the countries are calculated and all the details from human power to commerce are tackled when normalized. If it

is necessary to express the theme of GII; it is carried out through estimating the proportion of innovation inputs to innovation outputs and calculating their average to acquire the GII results. As can be seen from the below chart, the innovation inputs are composed of five fundamental titles and sub-titles.

The main titles are respectively; Institutions, Human Capital & Research, Infrastructure, Market Development, and Business Development. The Table 8 indicates the subrefractions of the Innovation Sub-Index. The innovation outputs, on the other hand, are tackled under two main titles. They are categorized into three sub-titles as Information Production, Information Impact and Information Prevalence. The other main title, Creative Outputs, is divided into under titles as Abstract Creative Outputs and Creative Products and Services.

The details are given in the Table 8.

Table 8: *Innovation Input and Output Sub-Index*

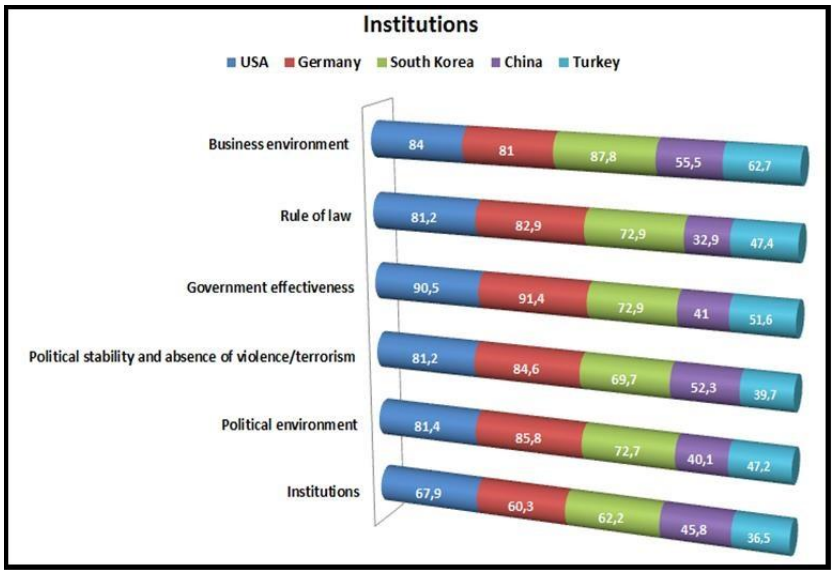


Note: (Cornell University, 2014)

3.1.2 **Country comparisons with Turkey on the basis of the GII indicators**

In this section, a comparison will be carried out between Turkey and U.S.A, Germany, South Korea and China on the basis of the GII data.

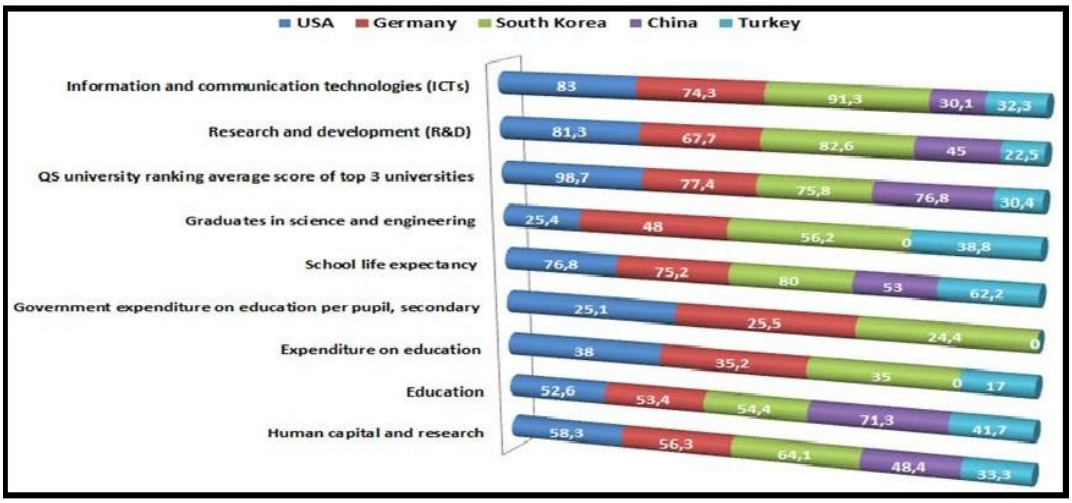
Table 9: *Institutions Indicator*



Note: *It prepared based on GII data. 2011, 2012, 2013, 2014.*

On the basis of the general institutions, Turkey lags behind U.S.A, South Korea, Germany and China. Turkey is in the position of being a country which has the lowest ration in the Political Stability and Terrorism/Violence assessment. Rules of law are the weak points of Turkey, and this leads Turkey to rank the last among the countries compared in the general average. Even though one of the strongest points of Turkey is deemed to be the governmental efficiency, she comes later than U.S.A, Germany and South Korea in the comparison.

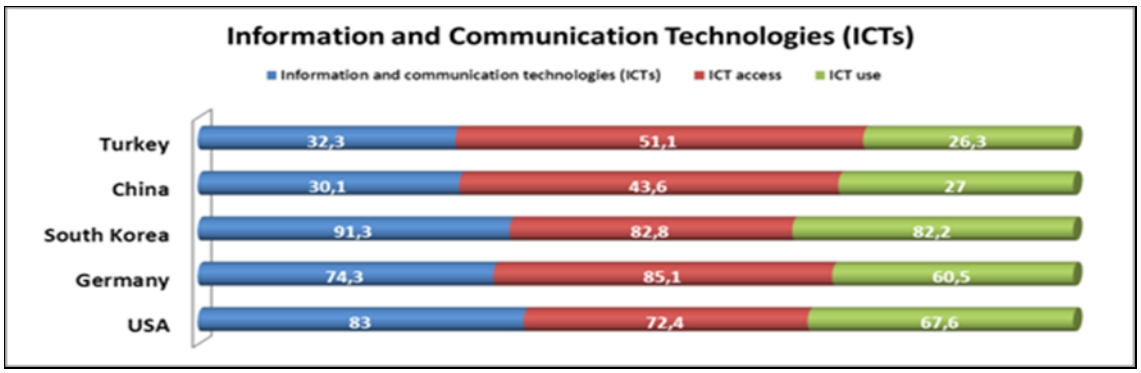
Table 10: *Human Capital & Research*



Note: *It prepared based on GII data. 2011, 2012, 2013, 2014.*

When these countries are compared in terms of human resources; Turkey ranks the last country in the comparison with the other mentioned countries; in the QS university ranking she has the same result. In the same way, Turkey lags behind the other countries in the comparison on the basis of the human resources and research, and R&D. Education spendings ratio is %62.2; and Turkey has a close chart to those of Germany and USA. In the field of students who study master's degree programs in Science and Engineering, on the other hand, Turkey has the highest ratio after South Korea. With %32.2 ratio in the Science and Communication Technologies field, Turkey is behind U.S.A. with %83 and Germany with %74.3.

Table 11: *Information &Communication Technology*



Note: *It prepared based on GII data. 2011, 2012, 2013, 2014.*

The details of this field are given in Chart 11. According to this Chart, Turkey's access to Information and Communication Technologies is %51, usage, on the other hand, is %26.3. It is deduced that the access rate to the Information and Communication Technologies can be developed structurally; however Turkey is observed to be weak in ICT usage. Consecutively, it can be that Turkey is relatively weak primarily in education, QS university ranking, human resources and research& development in the comparison among the other aforementioned countries.

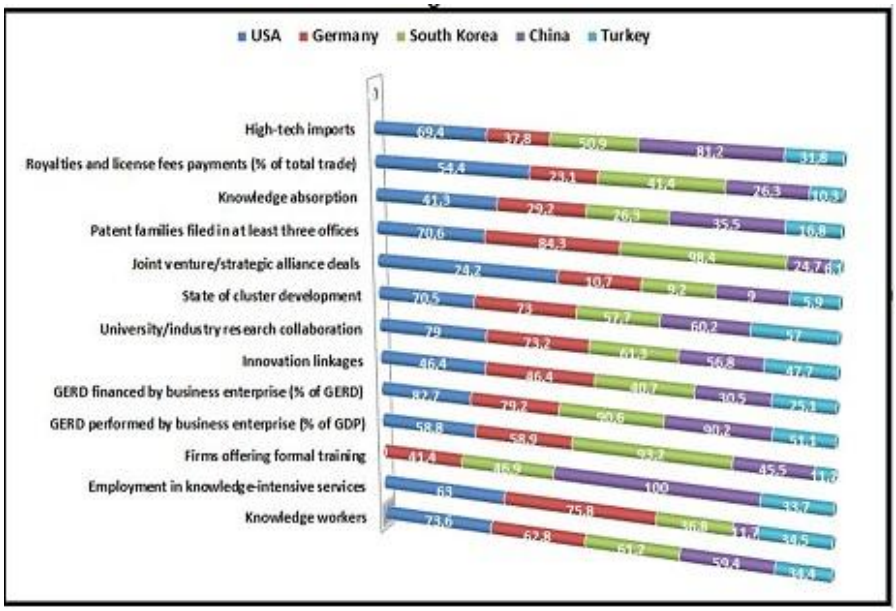
Table 12*: Market Sophistication*

Note: *It prepared based on GII data. 2011, 2012, 2013, 2014.*

Even though market development is observed to be one of the weak points in the compared fields, Turkey is ranked second in the non-agricultural exportation, penetration to market and competition; and third in the average customs ratio applied; and Turkey is at a strong position among the countries with which she is compared. On the other hand, it is understood from the chart that Turkey can be improved in the field of investment and entrepreneurship; yet she is weak in terms of micro-finance institutions credit portfolio. China's ratio in the micro-finance institutions' credit portfolio is %2.3, and is the best among the countries compared. The venture fund is 100% in the USA, and 52, 6% in Germany; and these are the highest ratios for the

countries compared. On the basis of this data, it can fairly be deduced that the USA and Germany value venture funds with the economic perspectives. In Turkey, on the other hand, the venture fund is expressed to be 0%; as a reason for this result, it can be stated that Turkey does not have sufficient amount of data or is weak in terms of venture fund. Turkey can increase its potential to have more venture fund by legally regulating the venture supports, incentivizing investments to support spin-off companies financially, and regulating cooperation in legal framework through international fund networks.

Table 13: *Knowledge Workers*



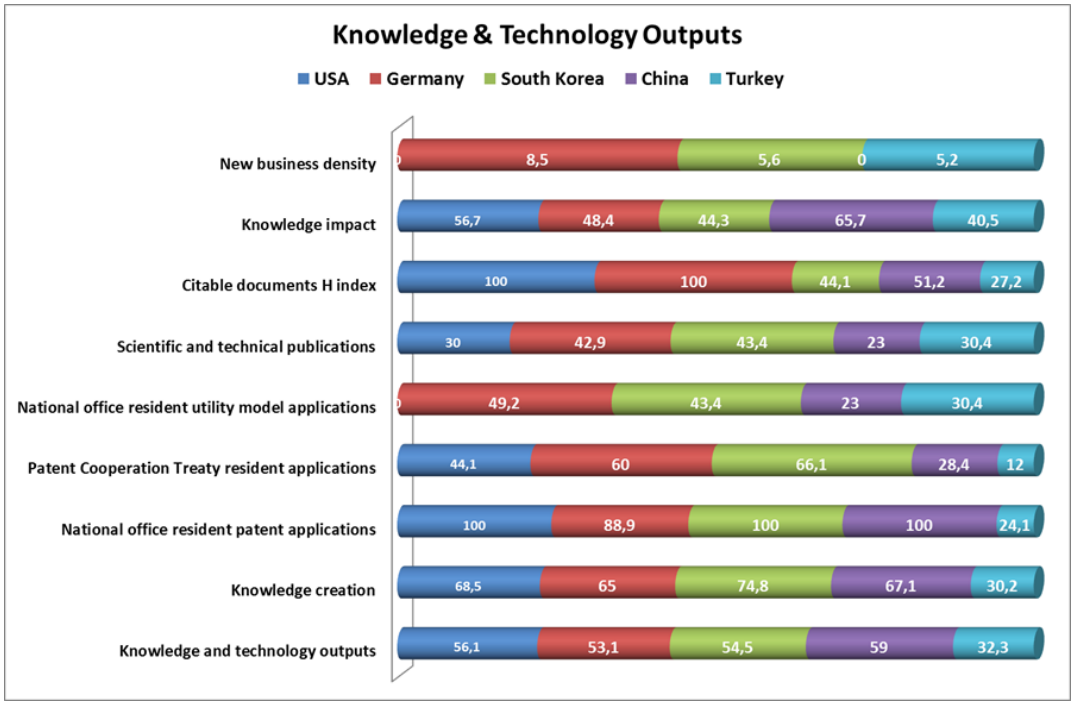
***Note**: It prepared based on GII data. 2011, 2012, 2013, 2014*

When we scrutinize the information workers and high technology inputs on the basis of Turkey and other countries' comparison; China has the highest ratio in the *advanced technology* importation. USA, South Korea, Germany and Turkey follow China. When it is taken into consideration that China has taken steps in this field, conducting reverse engineering structuring is provided through *advanced technology* importation.

Copyright and license fees, in ratio with the total commerce, draw a rather low graphic with a ratio of 10, 3% between Turkey and other countries. Similarly, the graphic is observed to be

quite low in the other fields, too. On the contrary to the decreasing graph in the inputs, when the Information and Technology outputs are examined, there are fields to be improved by Turkey and also fields in which Turkey is quite successful. Details of this topic are provided in charts 20 and (see.3.1.3)

Table 14: *Knowledge & Technology Outputs*



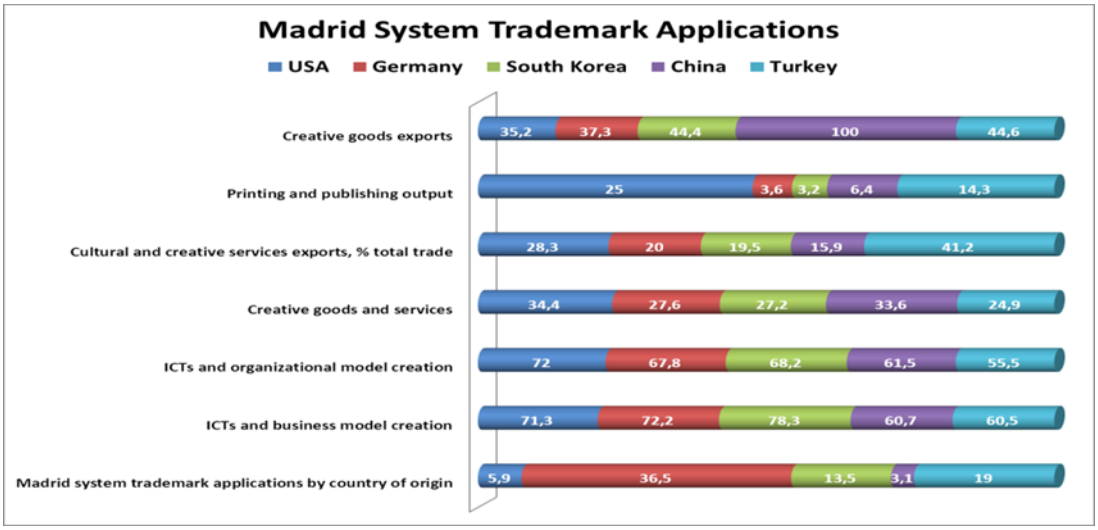
***Note**: It prepared based on GII data. 2011, 2012, 2013, 2014.*

In the Knowledge and Technology outputs comparison Chart 14; Turkey lags behind the other four countries in the fields of information effect, citation index data, national patent cooperation practices and information creating and national patent applications. China has the highest information impact, and the USA follows China. Similarly, the ranking is the same in information creation. In the Localized National Patent Cooperation, Germany and USA follow South Korea.

In the National Office Resident Patent applications, on the other hand, USA, South Korea and China has 100% rate, while Germany has 88, 9%, and Turkey has 24,1%. Although Turkey ranks third in the Scientific and Technical Publication rates, she ranks the last among the

countries compared in terms of citation rate. This result, in turn, impacts the consequence of information impacts. This leads Turkey rank the last of the countries compared and contrasted in the relevant fields. This impacts the Information and Technology outputs, which is the common title of all these fields. Turkey comes into forefront with a generally decreasing graph among the countries contrasted.

Table 15*: Madrid System Trademark Applications*



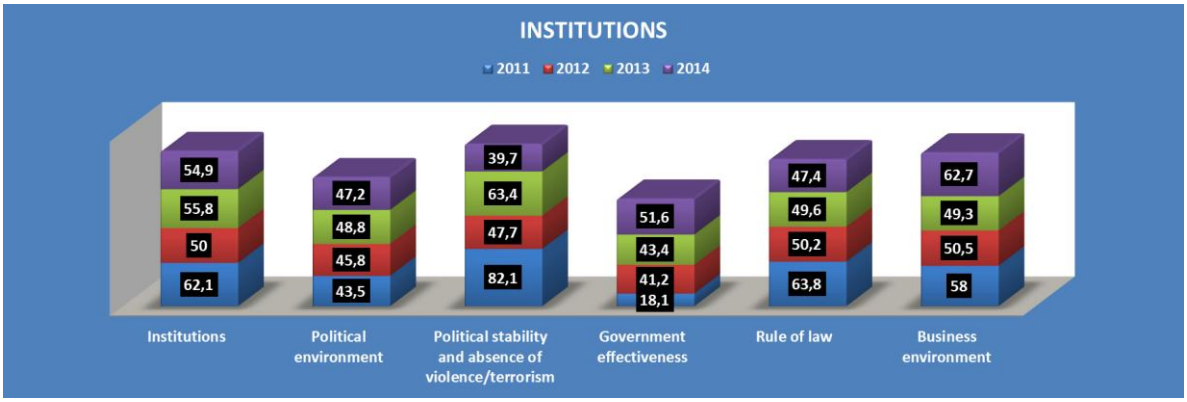
***Note**: It prepared based on GII data. 2011, 2012, 2013, 2014.*

When the Madrid System Brand Applications chart in table 15 is analyzed, it can be observed that Turkey comes second after China, which has 100%, with 44,6% in creative product exportation. Turkey ranks second, again, in the Press Outputs with 14,3% after the USA, which has 25%. Although Turkey comes first in the cultural and creative service exportation among the countries that are contrasted with 41,2%, she ranks the last in the creative product and service fields of brand applications with 24,9% rate. ICT and organizational modelling, ICT and business model creation are of similar situation for Turkey, and Turkey is placed in the last rank in the chart, as she has the least number ıf applications compared to the other countries. Compared to the countries in the common field in the Madrid System Application, on the other hand, Turkey ranks the second among the countries compared. According to this table, it can be deduced that Turkey has routes which can be improved in terms of creating brand value, and

applying to patents and beneficial models. Turkey's rates of applications to patents and beneficial models will be presented in the Turkey evaluation section of this study on the basis of the TÜİK (Turkish Statistical Institution) data.

3.1.3 **Turkey evaluation on the basis of the GII indicators**

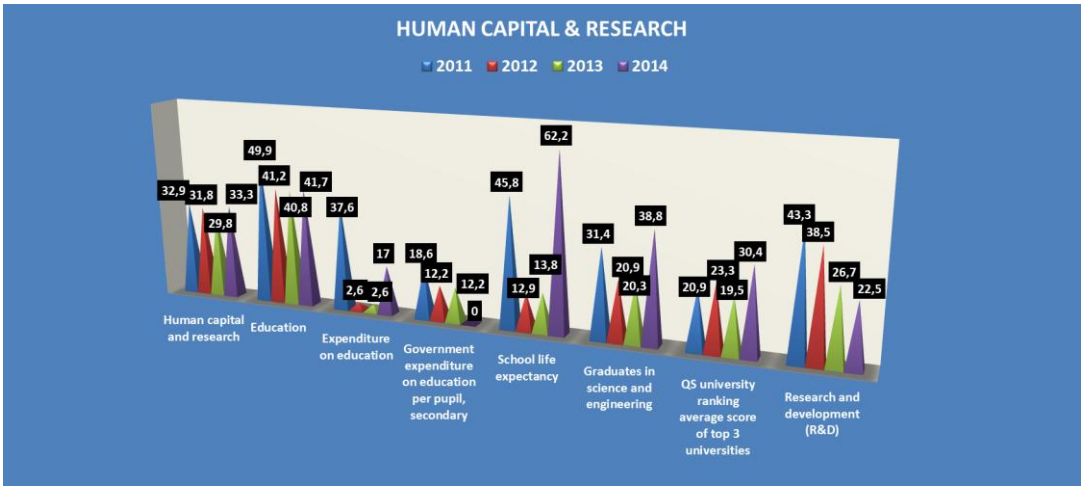
Table 16*: Institutions Indicator*



***Note**: It prepared based on GII data. 2011, 2012, 2013, 2014.*

In the Global Innovation Input Index of Turkey in 2011-2014, the situation is demonstrated in the Table 16 under the Institutions main heading. According to the Table; political environment, political stability, terror/violence, and legal regulations show a declining tendency. Even though government effectiveness or efficiency and business environment shows an increasing tendency, there has been a general decline in the institutions inputs as a main heading.

Table 17*: Human Capital & Reserach Indicator*



***Note**: It prepared based on GII data. 2011, 2012, 2013, 2014.*

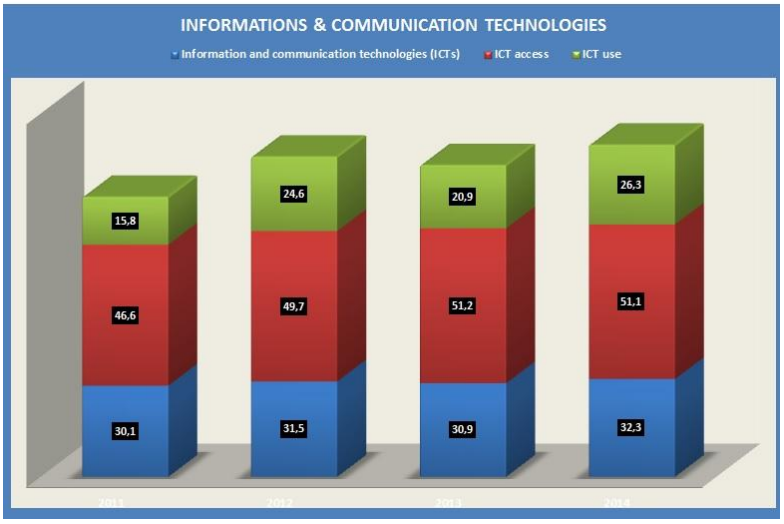
Turkey's situation in 2011-2014 in terms of the *Human Resources* in GII is demonstrated in Table 17. According to this data, *Human Resources* shows increasing tendency, although little. In the year 2011, there has been 0, 4 growth from 32,9%, and the rate has reached to 33,3% in 2014.

When the sub-refractions in this field are scrutinized, a decline is observed in *education* fields in terms of the *period of study*; the period of study regressed from 49, 9% in 2011 to 41, and 7% in 2014. A radical decline is observed in the education expenditures between the years of 2011 and 2012; a stable situation has been present between the years of 2012 and 2013, on the other hand. In 2014, there has been an increase of approximately 14%. There has been a decrease in the *education expenditures made by the government per student*. The rate, which was 18,1% in 2011, became 0% in 2014. Accordingly, as the government did not allocate any budget for education or the amount of budget allocate for education was not sufficient in 2014, it can interpreted that there is not any data in the index. Even though regress is observed between the years of 2011 and 2012 as regards to school life, it reached to 62,2 % in 2014, as can be understood from the analyses. The number of graduates in the field of Science and Engineering has shown decrease in 2012 and 2013 from 31,4% in 2011; on the other hand, there has been a slight increase recorded in 2014. In the first three universities grading index in the QS

University ranking, on the other hand, Turkey has a fluctuating graph in the GII. 2011 yearly average has shown increase in 2012, and decrease in 2013; and in 2014, the average increased anew. It can be understood that the R&D data of GII has a decreasing tendency.

Strong aspects of Turkey in the field of *Human Resources*; can be summarized as *university outputs, increasing tendency for the post-graduate departments,* and *increasing number of citation*. It can be deduced that Turkey has problems in terms of transferring her knowledge accumulation to R&D; and together with the solution of this problem, Turkey's relevant situation can be turned into an advantage.

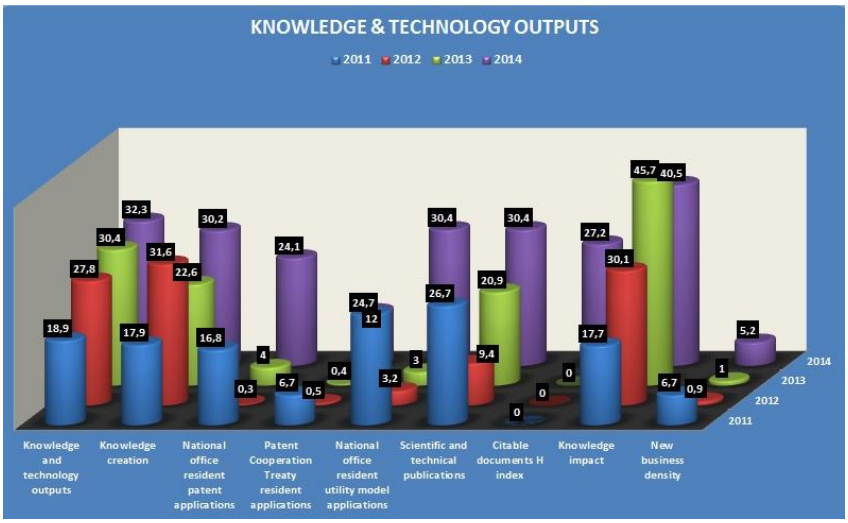
Table 18*: Information & Communication Technologies Indicator*



***Note**: It prepared based on GII data. 2011, 2012, 2013, 2014.*

Turkey's situation in 2011-2014 in terms of the Information and Communication Technologies in GII is demonstrated in Table 18. Accordingly, the general condition/rate of the Information and Communication Technologies; increased 2,4 from 30,9% in 2011 to 32,3% in 2014. Access to technology increased to the level of 51,1% with 4,5% growth in 2014 from 46,6% in 2011. Technology consumption, on the other hand, was 46,6% in 2011; and increased to 26,3% in 2014 with 10,5% growth in 2014.

Table 19: *Knowledge & Technologies Outputs Indicator*



***Note**: It prepared based on GII data. 2011, 2012, 2013, 2014.*

Knowledge and technology outputs are seen in the Table 19. According to this table, *Knowledge and technology outputs* show regular increase. *Knowledge and Technology Outputs*, which were 18,9% in 2011, increased to 32,3% in 2014, an increase of 13,4% was seen in this field. When the details are scrutinized, on the other hand, *the creation of knowledge* has shown increase. Knowledge creation, which was 18, 9% in 2011, reached to 32, 3% in 2014; and as a result, an increase of 13, 4% was observed. According to this data, Turkey can be interpreted as a country, the feature of which can be improved in terms of *knowledge creation.*

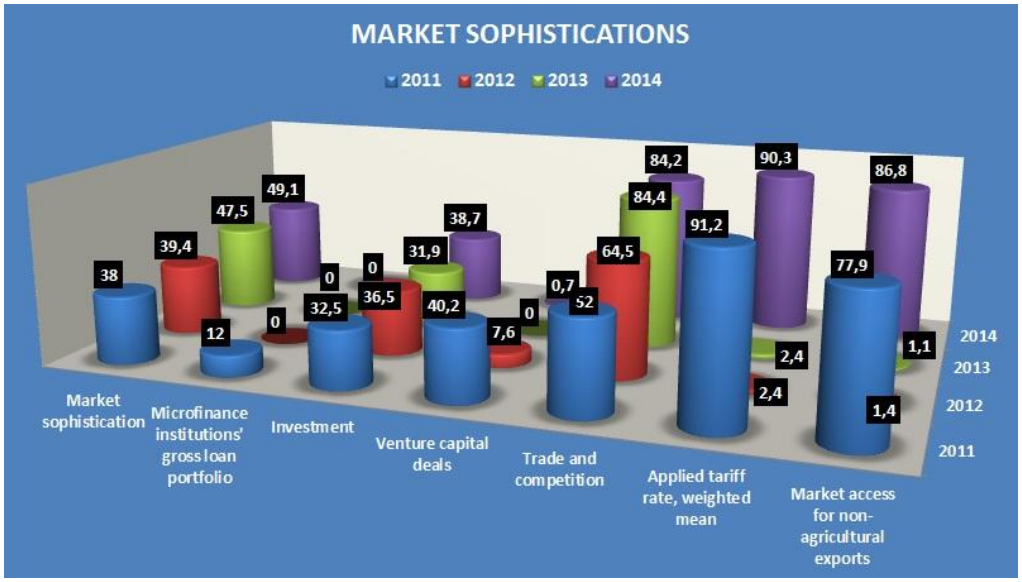
There has been a decrease of 16, 5% between the years of 2011 and 2012 in the national office patent applications; this rate has become the lowest rate as 0, 3% in 2012. This figure increased 3, 7% in 2013 and reached up to 4%; an advance of 20, 1% was gone through and reached to 24, 1% in 2014. In the field of permanent implementations in the patent agreements, shows similarity with the national patent applications. In 2011, the rate was 6,7%, while a deep decline was seen in 2012; in 2013-2014, on the other hand, it rapidly increased.

The national office established beneficial model applications show parallelism with the patent applications, as well. In the field of scientific and technical publications, on the other hand, a fluctuating graph is observed. The rate, which was 26, 7% in 2011, regressed to 9, 4% with a

deep decrease in 2012, and in 2013 and 2014; reached up to 30,4% with a rapid increase. In the index of the documents that can be cited, there is not any data for the years of 2011 and 2013; in 2013, 193 citations were done, but no estimation was carried out. The 2014 year rate, on the other hand, was determined to be 27, 2%.

Though the information impact increased between the years of 2011 and 2013, there has been a decrease of 5,2% in 2014, and remained to be 40,5%. In the field of new business intensiveness, there has been a declining tendency. In 2011, the rate which was 6,7%, increased to 5,2% in 2014; on the other side, this rate is not at a desired point when compared with the year 2011. Although information and technology outputs showed a general increasing graphic, it is obvious that it is necessary for Turkey to develop and advance especially in the field of patent and beneficial model applications. Furthermore, using and commercializing the knowledge are among the important fields which are necessary to be improved.

Table 20: Market Sophistication Indicator



***Note**: It prepared based on GII data. 2011, 2012, 2013, 2014.*

Turkey's situation between the years of 2011 – 2014 in terms of the GII Market Development can be scrutinized in the Table 20. In line with this, the Market Development indicates an increasing graph. It is seen from the details that the micro finance institutions' gross credit

portfolios were 12% in 2011, and decreased to 0% in the years of 2012-2013-2014. It is seen that the investment graph of the market is inclined to increasing pattern; it only showed a declining pattern in 2013. According to the GII; the rate of investment, which was 32,5% in 2011, reached up to the level of 38,7% in 2014. When the details of the *venture fund* are examined thoroughly, it has been reflected that there has been a general declining tendency. The venture fund, which was 40,2% in 2011, declined to the rate of 7,6% with a regressing of 32,6%; and this rate of venture fund decreased to 0% in 2013. When it comes to the year 2014, it showed an increase of 0,7%. In the research carried out in this field, it can be educed that results cannot be drawn because of the deficient knowledge, or the consciousness of entrepreneurship is not developed, the amount of supports for entrepreneurship is not adequate, or the incentives of the investors are not sufficient. It is observed that Turkey displays an increasing trend in the field of *trade* and *competition.* The trade and competition ratio, which was 52% in 2011, increased to 64,5% in 2012; and 84,4% in 2013; decreased 0,2% in 2014, and became 84,2% in the same year. When we look at the weighted average of the implemented customs rate, it was 91,2% in 2011, and in the years of 2012 and 2013, the ratio regressed to 2,4%, and increased to 90,3% in 2014. When the non-agricultural exportation is analyzed according to the GII, there has been a general increasing pattern. The rate, which was 77,9% in 2011, was recorded to be as high as 86,8% in 2014.

Table 21*: Madrid System Trademark Indicator*

***Note**: It prepared based on GII data. 2011, 2012, 2013, 2014.*

In Table 21, a general decrease was recorded in the Madrid System Brand Applications depending on the Country of origin. While the ratio was 36,2% in 2011, it became 19% in 2014 and while the ratio recorded an increase of 0,8% in 2013, it could not reach up to the rates of 2011. The rate, which was 63% in 2011, in the fields of ICT and Business Model Creation, regressed to the rate of 60,5% in 2014; and reached to its lowest level of 52,9% in 2012. The ICT and Organizational Model Creation field, on the other hand, the ratio was 53,1% in 2011; reached up to 55,5% in 2014; was in its lowest rate in 2011 with 46,1%. A decreasing pattern is observed in the field of Creative Product and Services. An increasing graph is present for the Cultural and Creative Service Exportation Total Trade Ratio. The rate which was 33,9% in 2011, has gone through a radical decrease in the years 2012 and 2013; it reached a higher level than 2011 in 2014, which is 41,2%. On the other hand, there is a decrease in the Printing and Publishing Outputs. The Printing and Publishing Outputs rate was 44,3% in 2011; the rate decreased radically in the years 2012 and 2013; but it could not reached the levels of 2011 in 2014 with a ratio of 14,3%. Creative product exports showed a decreasing pattern as the other fields in 2012 and 2013, yet there was an increasing ratio in the years 2014 and 2011. In 2011, the rate was 33,5%, and increased to the level of 44,6% in 2014. Although "Brand" creation and

creative product is evaluated to be one of the strong points of Turkey, it is an aspect needed to be improved for Turkey, as indicated in the data analysis sector in the GII Turkey data. In line with this data, it can be deduced that the production of new product/service is not adequate, and "Branding" of these products is of ultimate value.

3.2 **Evulation**

In this section, a Turkey assessment will be carried out on the basis of the literature analysis of the changes in the structures of the university, industry, and government institutions and their impacts on the R&D structures. The government supports for the regulations, incentives and international networks will be examined; the USA, Germany, South Korea, which is in the Global Innovation Index; China and Turkey, which have an increasing trend, will be compared and contrasted. In addition, analyses of the contribution and the place of the spin-off companies, angel investors, and development agencies in the university-industry-state cooperation will be provided in this section. In this context, the topic of the intellectual property rights will be tackled; the development process of the intellectual property rights in Turkey and an in-depth comparison of intellectual property rights of Turkey – USA – South Korea will be presented.

The research question of the thesis, which is; "What should be Turkey's innovation model in order for Turkey's reaching her R&D objectives?" will be endeavored to be answered in the last chapter of this extensive study, and a model suggestion will be propounded for Turkey through explications.

3.2.1 **Comparative analysis of Turkey and GII selected coutries**

Turkey, Germany, the USA, South Korea and China will be compared and contrasted as regards to the innovation ecosystem and R&D studies on the basis of the GII data within the scope of this chapter.

Turkey is at a weak point among the countries compared as regards to the institutions. It can be construed on the basis of the data that particularly the weakness in the political stability, violence/terrorism and legal regulations creates a major handicap in creating an innovation ecosystem and attracting investments to Turkey. In the *Anahtar* (*Key*) magazine published by the Ministry of Science and Technology; it is asserted that deficiency of policies impacting innovation is a primary threat against Turkey in being able to compete with the relevant countries; the instability in the current R&D policies, the narrowness of the scope in the regulations of Technology development Regions and Centers are stipulated to be weaknesses (Uygun, Demir, & Erdoğan, 2015).

Table 22*: Evaluation of Scientific Performance of Turkey and Country*

Evaluation of Scientific Performance of Turkey and Country					
	Germany	**USA**	**China**	**S. Korea**	**Turkey**
The total number of Scientific Document	143.284	537.308	392.164	67.688	25.018
In terms of the number of Scientific publications on World Ranking	4	1	2	11	18
Ranking to H Index	3	1	17	19	36

Note: *Thomson's ISI Web of Science* **(Uygun, Demir, & Erdoğan, 2015)**

On the basis of the data in Table 22 showing the scientific publication field, it can be uttered that the scientific publications increased quantitatively in Turkey, while there is a problem in qualitative aspect. There is a similar result in the GII comparison, as presented in the analysis chart of this study. Moreover, scientific outputs affect the qualified human resources, as well. As a result, it has emerged that universities should evolve into being entrepreneur universities in order to be able to grow expert human resources. The high number of young population in Turkey propounds the necessity for supporting the education and specialization that will serve added value to the working life. Although Turkey seems to be on equal terms with the countries compared in terms of access to Information and Communication Technologies, the ICT active usage is not at the desired level, yet it is seen as an area open to improvement.

Turkey can be estimated to be capable in creating opportunities for competitiveness in the field of market development, customs rate, and non-agricultural exportation, compared to the other aforementioned countries. The aspect to be improved in this field, on the other hand, is striking as the generation of entrepreneurship and venture fund.

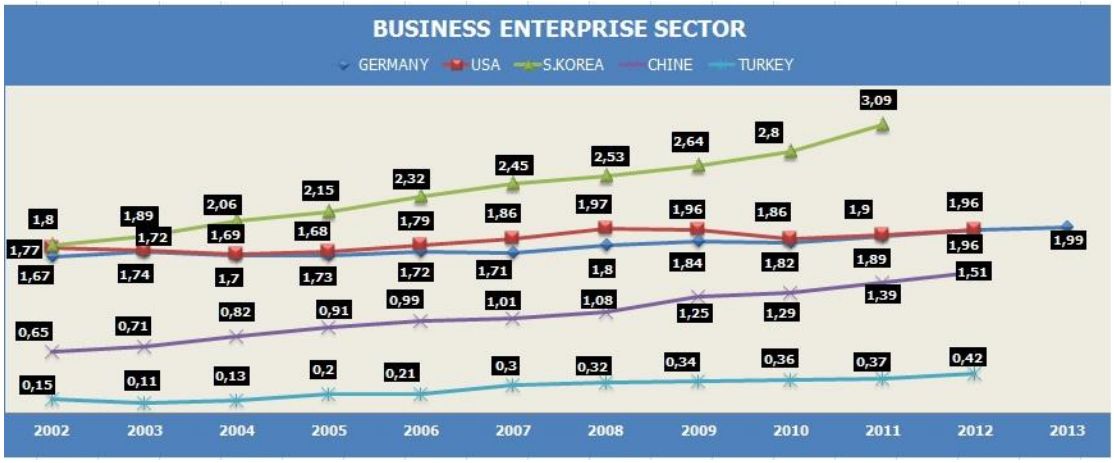
3.2.2 R&D development comparison between Turkey and other selected countries

In accordance with the Eurostat explanations, the fact that criteria like environmental and human factors are lacking in the economic developments and indicators in the official traditional statistical data such as GNP leads to the deficient development of social and environmental advance. For this reason, it is stated in the report about the Measurement of Welfare and Sustainable Development by the European Statistical System that implementation decision was taken to measure 50 actions. With this method, the impact of the revenue to be spent by a household and the way to provide environmental protection and its contribution to development can be measured (Eurostat, 2012).

As a content, creative studies conducted systematically to design new applications to increase the knowledge stock of the society, culture and population are of importance in terms of R&D performance; R&D expenditures for the commercial business sector in a certain period regardless of the financial resource, and the R&D intensity ratio in the GDP give clues about the development level (Eurostat, 2012).

In this context, analyzing of the R&D performance data of the countries compared on the basis of the sectors and Eurostat data, the R&D investment rates in the course of twelve years – 2000-2012 – in GDP will be compared and contrasted with the data compiled from the OECD, as well.

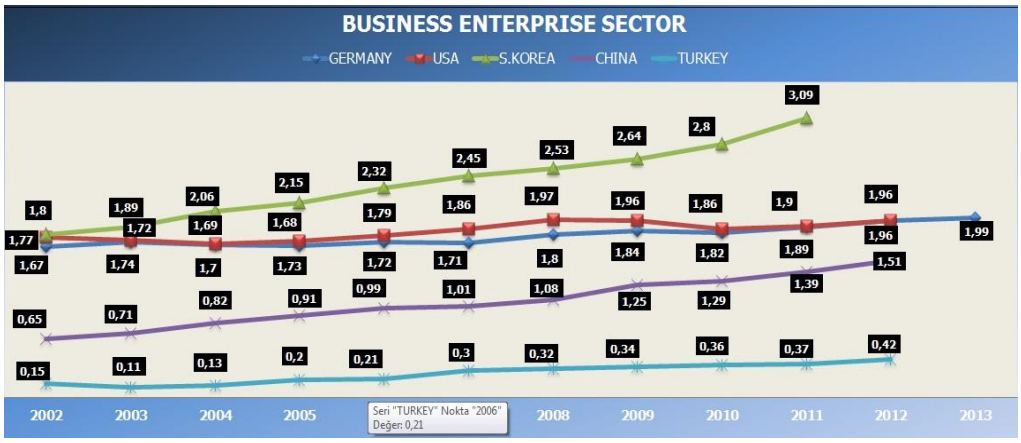
Table 23*: Business Enterprice sector R&D expenditure r**ate***



Note: *It prepared based on Eurostat, 2012*

When the Business Entreprice Sector spendings are compared and contrasted; South Korea shows an increasing graph, the USA showed a fluctuating graph until the year 2009, and showed a decreasing pattern after this year. China's graph displayed a regularly increasing pattern; Germany had a fluctuating graph with slight differences between the years of 2002-2005, but an increased was observed between 2010-2013. Turkey, on the other hand, had decreasing pattern between the years of 2002-2004, yet there has been an increasing trend in the R&D expenditures after the year 2004.

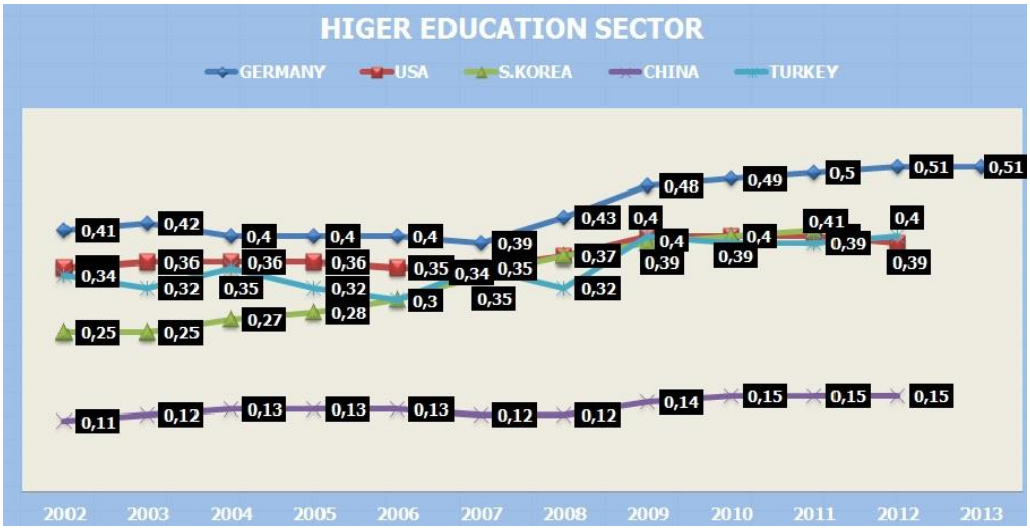
Table 24*: Government sector R&D expenditure rate*



Note: *It prepared based on Eurostat, 2012*

Departing from the R&D expenditures in the Government Sector presented in the Table 24, Germany had a relatively stable graphic in the highest rates and years; the USA followed this country. South Korea, on the other hand, had a stable graph up until the year 2008, the graph showed an increasing inclination after this year. China had an increasing graph in 2010, and even though Turkey had a stable graphic before 2010, it had relatively fixed graphs in the previous years.

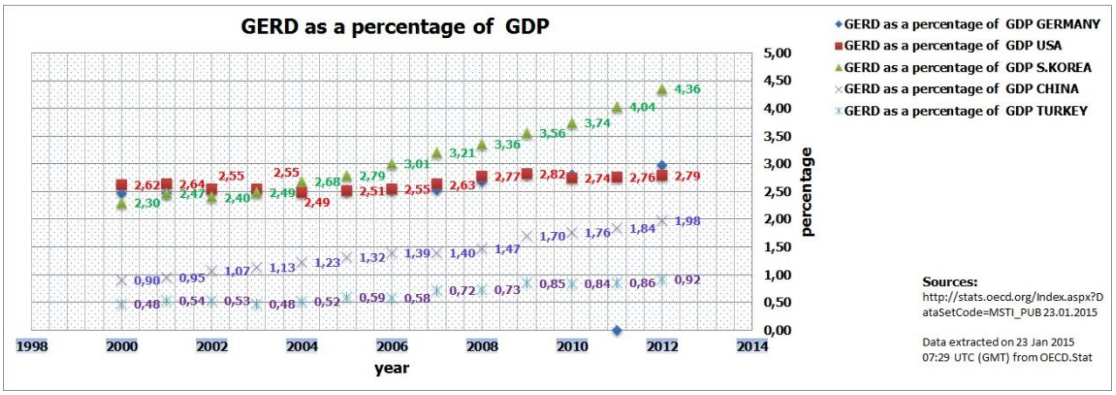
Table 25*: Higher Education Sector R&D expenditure rate*



Note: *It prepared based on Eurostat, 2012*

Germany, USA, Korea and Turkey have relatively similar routes in terms of the Higher Education Sector R&D spendings, yet it is observed that China legs behind. When an annual analysis is conducted, it is seen that even Turkey showed a slight decrease in 2008, there was an increase in the next year; the rates were stable in 2009. It is observed that all the countries except Korea had decreasing patters in 2007. In this field, an increase and linear graph were shown in the other countries, as Turkey.

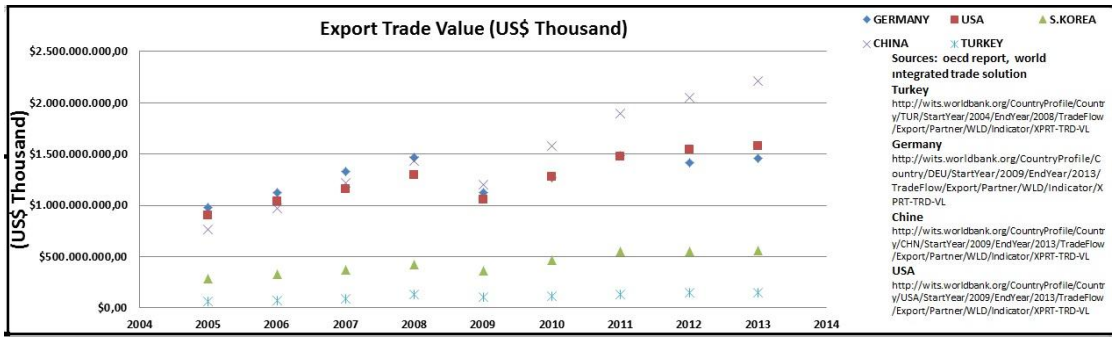
Table 26: *GERD as a Percentenge of GDP*



Note: *Data extracted on 23 Jan 2015 07:29 UTC (GMT) from OECD. (It prepared based on Stat* (OECD).

The countries' R&D investment rates within their GDPs according to the OECD are presented in Table 26. Turkey has a fluctuating graph in this field. China has an increasing graph after the year 2008, South Korea caught a steady increasing pattern in 2003 after declining graphs between the years of 2002-2003. Althoguh the USA had a decline until 2006 from the rate of 2,62% in 2000 before the 2008 crisis, she increased to the rate of 2,79% in 2014 after the 2008 crisis. Germany, on the other hand, displays a regular increasing pattern of graphs.

Table 27*:Export Trade Value*

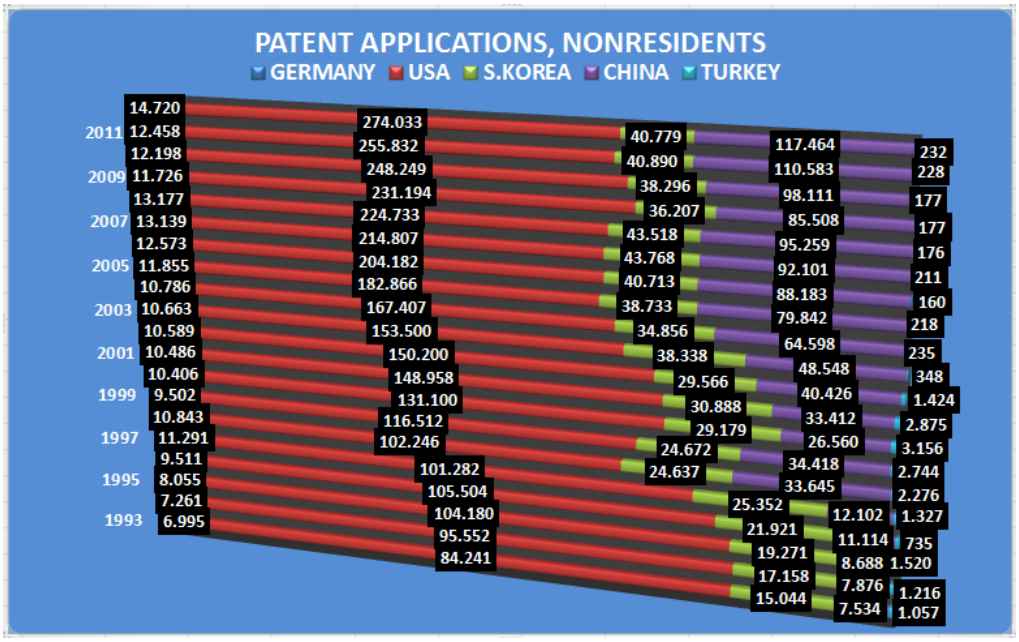


Note: *It prepared based on World Integrated Trade Solution ,* [*http://wits.worldbank.org/*](http://wits.worldbank.org/)

The exportation levels of the countries compared in Table 27 are shown in numeral value of dollar-denominated. The increaisng graph in export showed a decreasing line because of the 2008 economic crisis, however, there has been an increasing tendency after 2010. Among the

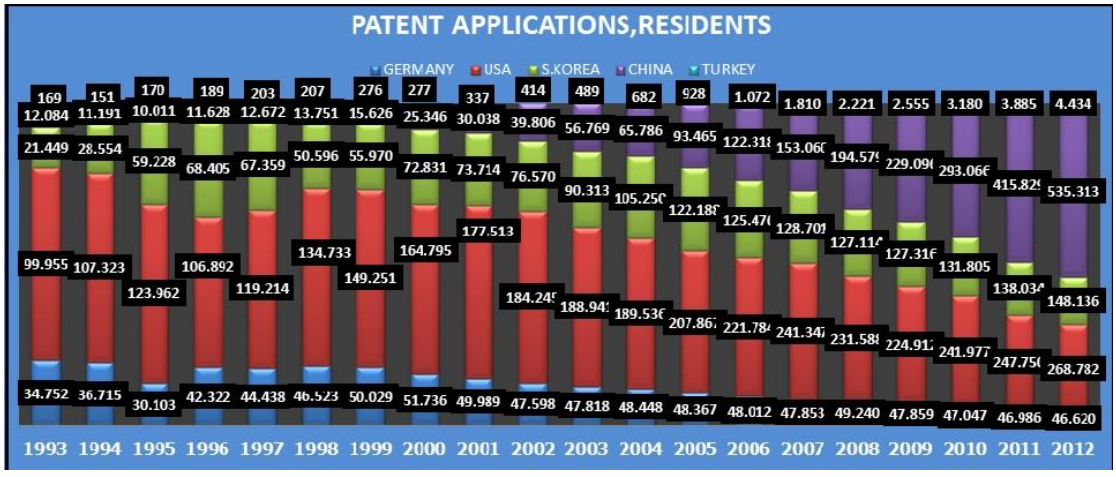
countries compared, the USA, Germany, South Korea and Turkey follow respectly China, which has the highest export revenues.

Table 28*: Patent Applications, Non-residents*



Note: *It prepared based on http://data.worldbank.org/indicator/IP.PAT.NRES/countries*

Table 29: *Patent Applications, Residents.*

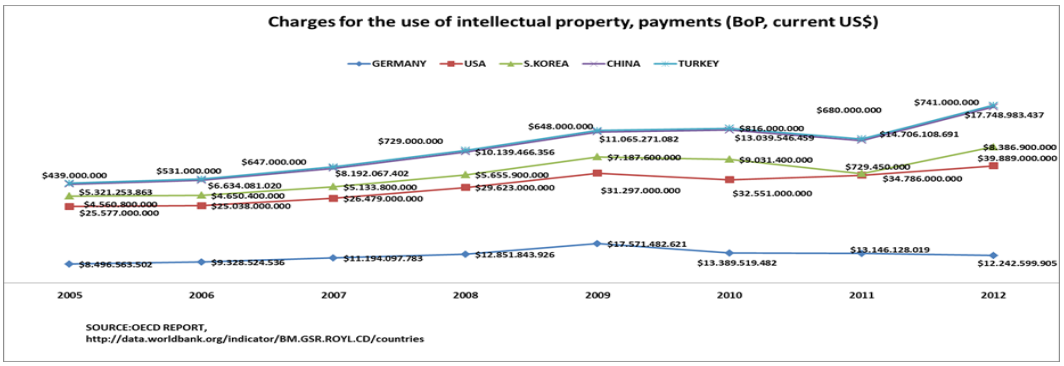


Note: *It prepared based on http://data.worldbank.org/indicator/IP.PAT.RESD/countries)*

Table 28 reflects the country distributions of the Local Patent Applications and Table 29 indicates the Non-Local Patent Applications in the name of the countries compared within the scope of this study. Accordingly, China peaked in the Non-Local Patent Applications in 1997,

and in Local Patent Applications after 2000, and followed a regular increasing pattern. On the contrary, event thouth Turkey had an increasign pattern in the Non-Local Patent Applications category from 1996 to 2002, she showed a sudden decrease in 2003 and continued decreasing pattern afterwards. In the Local Patent Applications category, on the other hand, Turkey had an increasing graph until 2008, but showed declining inclination after this year.

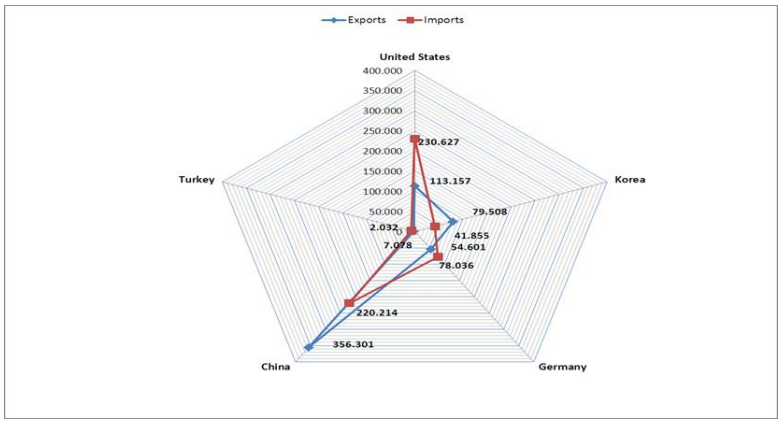
Table 30: *Charges for use of IP, payments*



Note: *It prepared based on http://data.worldbank.org/indicator/BM.GSR.ROYL.CD/countries*

When Table 30 is scrutinized, it is observed that South Korea had the largest investment for the patent applications. Along with that, decreasing patterns are observed for all countries except Germany in terms of patent spendings in the years 2008 and 2011; there has been an increase recorded in the following year. The reason for the decreases in these years can be interpreted as the fact that the global economic crisis has had its reflections on the patent spendings.

Table 31***: ICT Technology import and export rates***



Note: It prepared based on Eurostat, 2012 *HTTP://DATA.WORLDBANK.ORG*.

The countries' ICT technology import and export rates data are settled in Table 31. China ranks the first in ICT export, the USA comes second. Recently, ICT production glided in China, as a result, production of their own products created a difference in their export figures. Germany and Turkey follows up South Korea, which ranks the third in this list. The export weight of the USA, Germany and South Korea is composed of their own brands.

It can be fairly uttered that the countries compared in this category have their own national innovation structures and in line with this, it can be stated that these countries have determined their primary fields and structured their innovation ecosystems (see appendix 2).

3.2.3 **Turkey assessment on the basis of TÜİK (Turkish Statistical Institute) and GII**

Turkey will be assessed under three main headings, as in the literature scan of the thesis, on the basis of TÜİK and GII data in this chapter.

In the first chapter, the Turkish universities will be assessed on the basis of their situation, education style, world university integration, number of students, education method and the impact of university education on the industry and market. In the second chapter, Turkish industry will be scrutinized through GII and TÜİK. The condition of the primary sectors contributing to the Turkish economy, innovation and R&D structures will be evaluated in-depth. In the third chapter, government incentives, Turkey's state incentives in line with this objective, legal regulation, usage of the relevant incentives, and exportation levels will be evaluated on the basis of the TÜİK and Turkish Exporters Assembly (TEA) data.

3.2.3.1 **Analysis of Turkish universities**

Turkish universities will be analysed from the entrepreneur and innovative perspective. Scientific and Technological Research Council of Turkey (TUBİTAK) and innovative university index indicator will be analysed in five dimensions and 23 indicators (TÜBİTAK,

2015). As can be seen from Figure 11, the 5 dimensions of the entrepreneur and innovative universities are: “Scientific and Technological Research Competency, Intellectual Property Pool, Cooperation and Interaction, Entrepreneurship and Innovation Culture, Economic Contribution and Commercialization”.

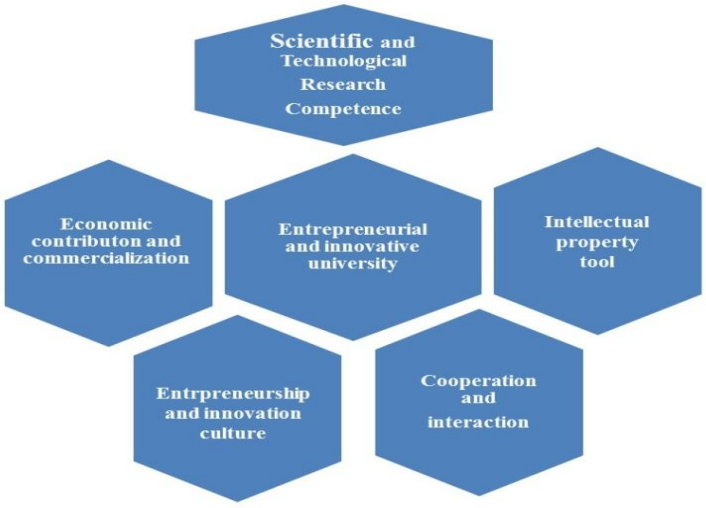


Figure 11: *Size Entrepreneurs And Innovative University Index.* **(TÜBİTAK, 2015)**

The weight average of the Scientific and Technological Research Competency is 20%, the indicators of this dimension are: “The number of scientific publications, citation number, the number of projects acquired from the R&D and innovation support programs, the amount of funds acquired from the innovation support programs, number of national and international scientific awards, and the number of graduates with a PhD”. The second dimension, the Intellectual Property Pool and weight average is 15%. The indicators of the Intellectual Property Pool are; “The number of patent applications, number of patent documents, number of the documents of beneficial model/industrial design, and number of international patent applications.”

Cooperation and Interaction is the third dimension, and the weight average is 25%. The indicators of this dimension are: “number of R&D and innovation projects conducted within the scope of the university-industry cooperation, the amount of the funds received from the R&D

and innovation projects conducted within the scope of the university-industry cooperation, and the number of instructor/students in circulation". In Entrepreneurship and Innovation Culture, which is the fourth dimension, the weight average is 15%, and the indicators are; "entrepreneurship at the level of graduate and post-graduate education, the number of courses in technology management and innovation management, Technology Transfer Office, techno-park, business incubators and the number of personnel working full-time in the Technology Development Centres (TEKMER), the existence of Technology Transfer Office structuring, entrepreneurship oriented towards the activities outside universities, number of education/certificate programs in technology management and innovation management". Economic Contribution and Commercialization, which is the last dimension, has a weight average of 25%, and the indicators are; "the number of active companies owned or co-pioneered by the academicians in the techno-parks, business incubators, TEKMERs, the number of active companies owned or co-pioneered by the university students or graduates within the last five years in the business incubators, and TEKMERs, the number of recruited personnel by the academicians in the techno-parks, business incubators, TEKMERs, and the number of graduate patent/beneficial model/industrial design" (TÜBİTAK, 2015). In line with these criteria, Turkey's entrepreneur universities are determined. The first 10 rankings of 2014 are shown in Table 30. It is stated in the TÜBİTAK chart that 2013 Board of Higher Education data are prepared and 23 universities with Professors, Associate Professors and Assistant Professors fewer than 50 are not incorporated in the analysis. In addition, the total number of Professors, Associate Professors and Assistant Professors are used when normalizing the data, the Entrepreneurship and Innovation Culture dimension, on the other hand, is not normalized (tubitak.gov.tr, 2014).

Table 32*: Enterpreneurial And Innovative University Index Ranking of Top 10*

Entrepreneurial and Innovative University Index 2014 Ranking of the Top 10							
Rankig No	University	Total	Scientific and Technological Research Competence	Intellectual Property Rights Pool	Cooperation and Interaction	Entrepreneurship and Innovation Culture	Economic Contribution and Commercialization
1	Middle East Technical University	83,09	19,6	22,4	8,7	13,8	18,8
2	Sabanci University	81,44	19,5	6,2	25	12,5	18,3
3	Boğaziçi University	76,34	18,5	5,5	24,1	10	18,2
4	İhsan Doğramacı Bilkent University	74,96	19,1	5,2	22,4	12,7	15,6
5	Koç University	73,59	16	9,4	24,9	11,3	12
6	Özyeğin University	73,06	16	9,4	24,9	11,3	12
7	Istanbul Technical University	72,42	15,7	6,8	21,1	10,1	18,8
8	TOBB University of Economics & Technology	69,26	16,2	7,1	18,7	9	18,3
9	İzmir Institute of Technology	67,83	19,5	5,8	22,1	7,9	12,5
10	Selçuk University	59,58	11,7	10,4	12	13,3	12,2

Note: (tubitak.gov.tr, 2014)

There are totally 59.912 students studying at the PhD level in the Turkish universities (Informatics Institute METU). As regards to the university contribution to the industry; post-graduate and PhD R&D personnel number are of significant criteria. According to the statistics published by the Ministry of Science and Technology in 2014, 363 of the 21.578 R&D personnel study PhD, there are 4.295 post-graduates, and totally 4.658 master programs students (Ministry of Science and Technology, 2014). According to the relevant 2012 figures, it is observed that 21,59% of the R&D personnel are post-graduate or PhD graduates. Yet, it can be stated that the fact that the rate of specialization is weak in the Turkish universities causes a handicap in transferring the sufficient amount of specialized human resources to the industry, on the basis of the GII data. In addition to that, the inadequate amount of interaction between the universities and industry can be deduced on the basis of the same data.

Even though the number of Scientific Publications is increasing in Turkey, the amount of citation is less than the publications, and this, in turn, paves the way for the result that publications are not sufficient in terms of qualitative aspect. In the *Anahtar (Key)* magazine published by the Ministry of Science and Industry, in the assessments by Uygun et al., there has been an increasing of eight digits in 10 years in the publication rankings, on the other hand, only four digit increase is seen in the number of citation (Uygun, Demir, & Erdoğan, 2015).

The number of scientists in Turkey is a field needed to be improved as regards to the quality of the research institutions, in line with the index data.

In terms of creating an innovation ecosystem, the university structures must evolve into "Entrepreneur University" model, as declared in the literature scan chapter of this thesis. Universities must orient themselves towards specialization in their strong points, and cooperate with the industrial entities, thereby pave the way for the evolution of the international universities.

3.2.3.2 **Analysis of industry in Turkey**

The analysis of The Turkish industry will be carried out on the basis of GII and Turkish Statistical Institute data. The primary sectors creating added value to the Turkish economy, innovation ecosystem and R&D structures will be further scrutinized. In the Ministry of Science, Industry and Technology's report, it is stated that 21.578 personnel are working in 154 R&D Centres as of 2012, 5.186 projects are carried out, and 1043 patents were received. The sectorial distribution of the R&D centres is demonstrated in the graphic in chart 12.

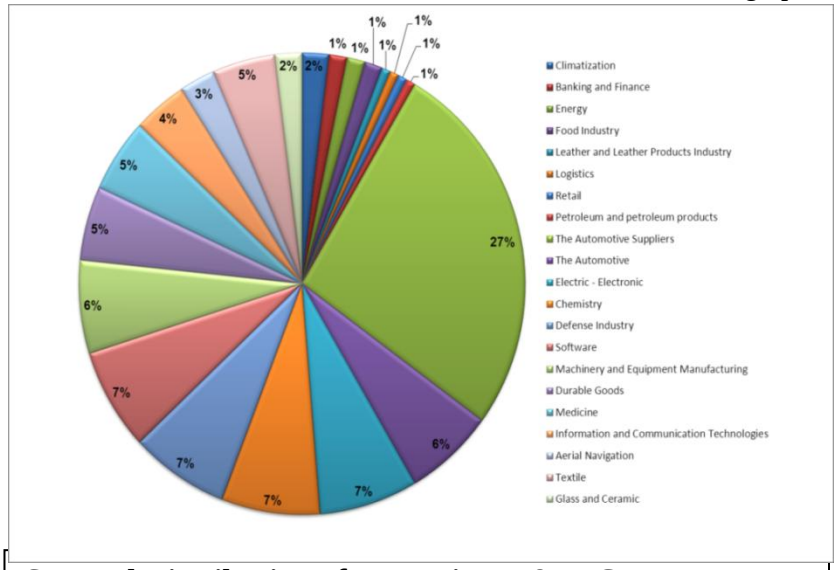


Figure 12: *Sectoral Distribution of R&D Centers* **(T.C. Bilim, Sanayi ve Teknoloji Bakanlığı, 2015)**

The index is prepared through analysing 3 categories and 6 dimensions. 81 of the 150 R&D Centres among 154 Centres complying with the performance criteria were taken into analysis; 69 of them were subjected to ranking process, and it is uttered that assessment was carried out on the basis of the 2012 data (Ministry of Science and Technology, 2014). In accordance with this index, the most successful R&D centres were determined and demonstrated in tables 11.

Table 33*: The most successful R&D Centres in sector*

SECTOR	R & D SECTOR
Defence Industry	Aselsan
Textile Industry	Kordsa Global
Electronic	Vestel Electronic
Durable Goods	Arçelik
Aviation	TUSAŞ Türk Aviation
Machinery and Equipment Industry	BOSCH Thermo Technical Industry & Trade
Computer and Communication Technologies	AIRTIES Wireless Communication Industry
Automative Suppliers	FARPLAS Auto Spare Parts Production Industry
Chemistry	DYO Paint Factories, Industrial & Commercial
Medicine	Zentiva Health Product Industrial & Commmercial
Glass and Ceramic	Eczacıbaşı Building Materials Industry
Telecommunication	NETAŞ Telecommunication
Software	C/S Information Technologies

Note**: (Republic of Tukey Ministry of Science, Industry and Technology, 2015).**

When the table 33 and figure 12 are examined, the locomotive sectors of Turkey are observed to be the Automotive, Defence Industry, Durable Consumption, Computer and Communication sectors.

As stated in the literature section, the sustainability of the R&D ecosystem is seen as one of the fundamental milestones of economic growth and development. The actors shall act in harmony at macro and micro levels and they should have clear expectations from each other in order to be able to collaborate without any intervention. As can be remembered from the literature section of this study, the actors are composed of universities, private sector, public institutions and organizations, non-governmental organizations, and in micro levels; the environmental factors, legal regulations, corporate R&D structures, project-based supports, risk capital, entrepreneurship and commercialization supports, intellectual property rights, standards; and in macro level; the environmental factors, education system and social environment, cultural

structure, technological environment and globalization. It has been uttered that different shareholders undertake different kinds of roles in the processes of policy-making and management (Eser, 2014; Kiper, 2010). In this context, Chart 13 shows the relations between the actors:

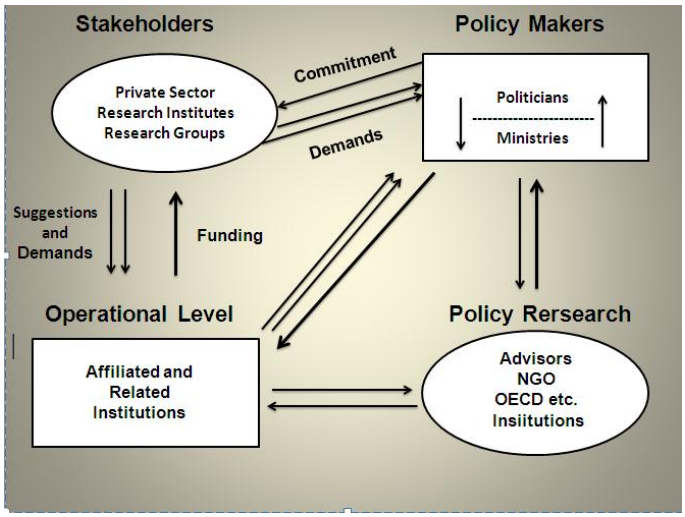
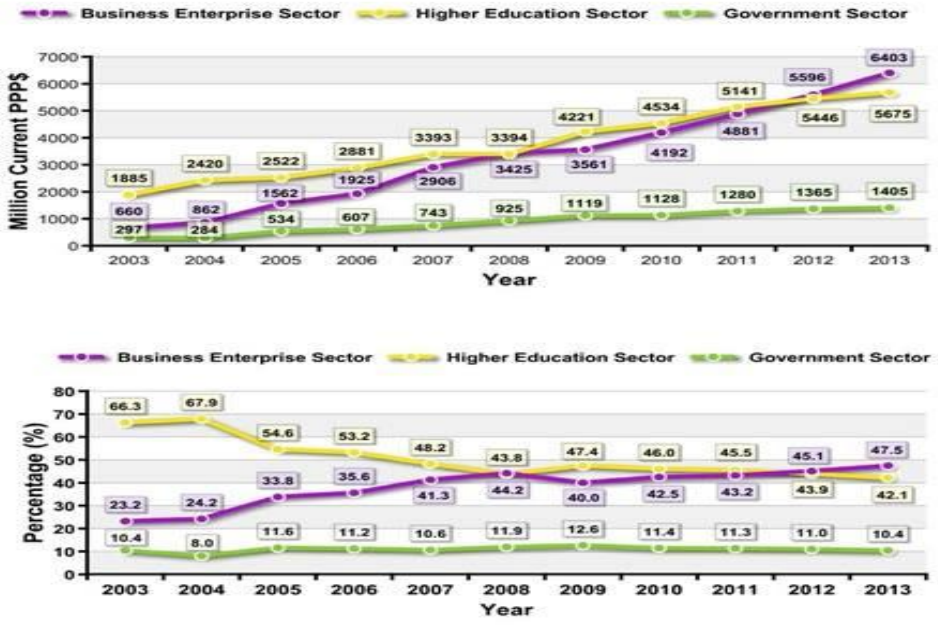


Figure 13: *Actors Relations Between The R&D And Innovation Systems* **(Eser, 2014)**

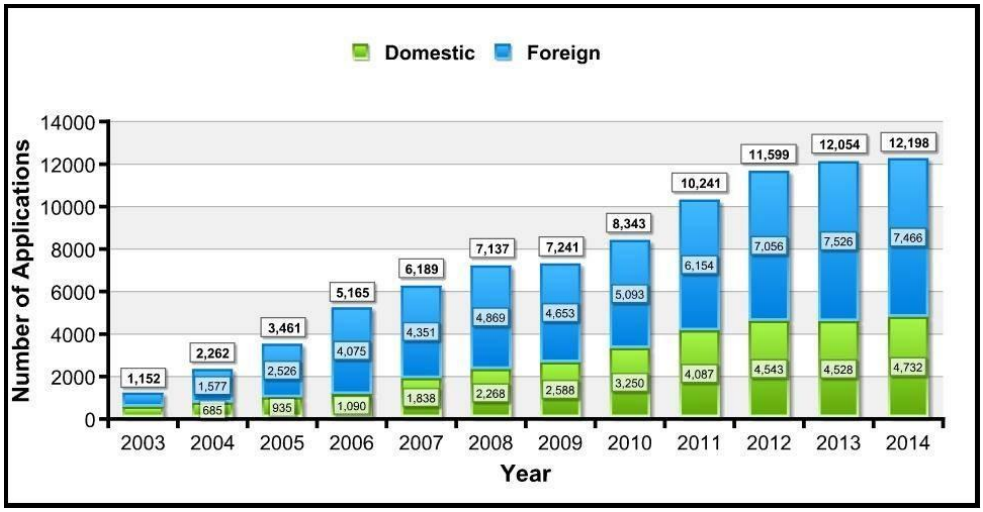
Table 34*: Sectoral R&D Expenditure*



Note: **(TÜBİTAK, 2015)**

The R&D spendings done in Turkey on annual basis are shown in the Chart 34 with the 2014 fixed prices; and it can be observed that the private sector and post graduate education sector were spent much more than public sector on the R&D studies. While the post graduate or higher education had the highest spending rate of 67,9% in 2004 for R&D investments, it displayed a declining graph in 2013 with the lowest rate of 42,1%. The private sector, on the other hand, showed a rising graph in 2003 with 23, 2%, and in 2013, it reached 47,5% rate. Although the public sector reached its highest rate in 2009 after 2003, it regressed to its rates of 2003 in 2013, and in general terms, had stable rates of R&D spendings. The 2008 economic crisis had negative reflections on the private sector and higher education parameters, causing declines in R&D spendings; in the public sector, on the other hand, the crisis gave rise to a rise, as can be observed.

Table 35*: TPI patent applications by year*



Note: **(TÜBİTAK, 2015)**

When the patent applications are scrutinized, it can be assured that there has been a regular increasing tendency. Yet, if the details of the patent applications are examined, it can be seen that the foreign financed companies have had more patent applications than those of the Turkish-originated companies, which is clearly demonstrated in Table 35, 12.054 patent applications were made with the fixed prices of 2013 in 2014; 7466 of the patent applications

were carried out by foreign companies, and 4732 applications were actualized by local companies, which is a striking fact.

While the R&D departments were working independently in the past, together with innovation and cooperation, the product/service generation properties of the companies started to change, as well. Network structuring paved the way for open innovation system and collective working method. The R&D structures of the innovative companies today have given rise to a method of working on the basis of projects through inter-departmental cooperation. In an innovative company, not an idea coming just from one department, but any kind of creative idea in the field of product/service is assessed and can be commercialized. Foreign suppliers, business partners, solution partners, and collaborators of companies provide contribution to the creative production processes. Within this procedure, only one idea out of 60 ideas propounded for the product or service, for which R&D studies will be carried out, is generated and commercialized. Figure 14 demonstrates the innovative research process.

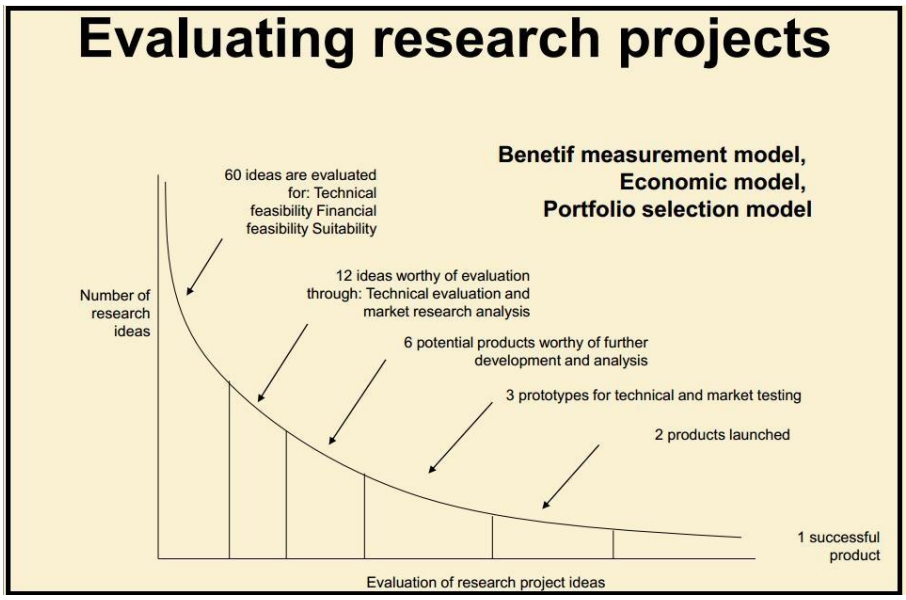


Figure 14: Evaluation Of Research Model (Adapted from D.L. Babcock (1996) Managing Engineering Technology: An Introduction toManagement forEngineers, 2nd edn, Prentice-Hall, London. Trott, 2005)

In order for the companies compete and sustain their existences in global arena, they need to allocate certain amount of their annual turnover for developing innovative products, in addition to their primary work, as was clearly emphasized in the literature section of this study. Within this framework, it is seen that companies active in Turkey are carrying out joint works with especially international companies and collaborate with universities. Information shown in the table demonstrating the applications to the Turkish Patent Institute (TPI) outlines that foreign-financed companies operating in Turkey are trying to hold on to the know-how studies, and getting sensitively their intellectual rights.

3.2.3.3 **Analysis of the state role in Turkey**

It has been frequently underlined in various studies that innovation is indispensable in order to be able to create sustainable development in the globalizing economic world. One of the actors important in making innovation possible is the "state". As stated in the literature section, the governmental institutions are responsible for the factors such as legal regulations and political stability that will create the innovation cultural infrastructure and ecosystem. It has been observed in the analyses of GII institutions heading in this study that the government's responsibilities and tasks are subjected to measurement. The legal system, political stability, terror/violence, governmental efficiency, and freedom of press take place among the factors playing important roles in the R&D spending analyses.

Turkey's governmental efficiency rate is perceived as an opportunity in the index. It can be interpreted that mostly the incentives and corporate regulations carried out recently pave the way for increasing of this rate. Notwithstanding that, it is also stressed in the literature that the country has certain issues is utilizing the legal regulations and incentives. Furthermore, the problems gone through but Turkey in terms of political stability, terror/violence bear importance as regards to the reason that it incorporates the trust factor in international cooperation.

In addition to this, it is also necessary to fit the regulations in necessary to be implemented in the education field to create innovation culture, and regulations to support university-industry cooperation into legal framework.

The *Statutory Decree numbered 635* and issued in 03.06.2011 in Turkey regulated the name change of the Ministry of Industry and Commerce to "Ministry of Science, Industry and Technology". The Ministry defines its vision as; "pioneering in the creation of a Turkey which takes place among the first ten countries, which are the most developed of the world with their information-based and competitive economic structures founded upon entrepreneurship, innovativeness, scientific development and technology production of high added value." The Ministry explicated it mission, on the other hand, as such; "In line with increasing our country's competitive power in global scale; developing and implementing policies, strategies, plans and programs in the fields of Science, Industry and Technology; incentivizing thinking on the basis of scientific knowledge in the process of transformation to an information society; creating a sustainable production structure which has high added value, is based on advanced technology, efficient, sensitive to environment, reduces dependency on foreign countries, and trustworthy; developing University-Industry cooperation, empowering the technological infrastructure of the country's industry by the supports provided for the R&D studies, incentives for innovation, being primarily the SMEs, increasing the competitive power, providing safe product supply and circulation oriented towards protection of users and prevention of unfair competition" (Republic of Turkey, Ministry of Science, Industry and Technology, 2011).

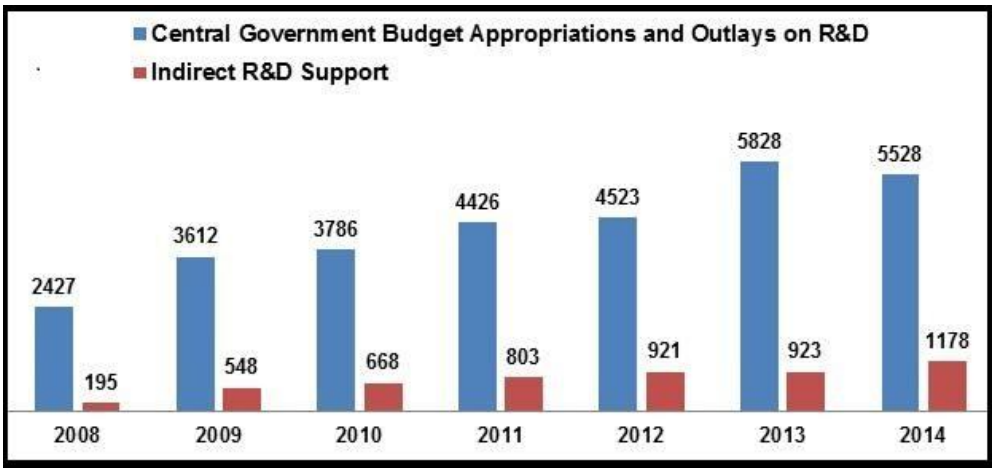
In accordance with the Ministry's vision and mission, Turkish Patent Institute (TPI) and Turkish Academy of Sciences (TAS) take action as organizations affiliated with the ministry. In addition, it is observed that Small and Medium Enterprises Development Organization (KOSGEB), Scientific and Technological Research Council of Turkey (TÜBİTAK) and Turkish Standards Institute (TSE) are in the organization scheme within the body of the

ministry as relevant institutions (Republic of Turkey, Ministry of Science, Industry and Technology, 2011).

Minister of Science, Industry and Technology of Republic of Turkey, Fikri Işıklar, stated in his press statement in 2014 that the Gross Domestic R&D Spending in 2013 in Turkey increased 13,4% compared to the previous year, and reached to 14 billion 807 million TL; the share of this figure in the Gross Domestic Product (GDP) in 2013, which was 0,92% of R&D expenditures in the previous year, increased to 0,95%. He further stated that the ministry supported corporate organizations and structures such as Technology Development Regions, R&D Centres, and Technology Transfer Offices; provided supports for projects such as San-Tez (Industrial Theses Support Program), techno-incentives, Technological Product Promotion and Marketing, Technological Product Investment and Support Program; and these supports can provide important contributions to the creation of an active R&D, innovation and entrepreneurship ecosystem and formation of corporate and sustainable structures in Turkey. Besides, he emphasizes that full-time R&D personnel recruitment is incentivized. The private sector's share in the financial resources is approaching to 50%, and this increase in funds results from the R&D centres established in companies, and projects carried out, again, in these companies, as uttered by the minister (Republic of Turkey, Ministry of Science, Industry and Technology, Press Consultancy, 2014).

One of the state's roles is expressed to be the allocation of grants to R&D expenditures. In this sense, the financial support allocated for organizations from the Turkish budget and the direct and indirect R&D supports are shown in the Table 36. According to the TSI data, in 2013, the R&D expenditures were determined to be 5.828.000 TL from the central budget, and the indirect R&D studies support was 923.000.000 TL. On the basis of this data, the starting allowance in 2014 was projected to be 5.528.000 TL (TSI, 2014).

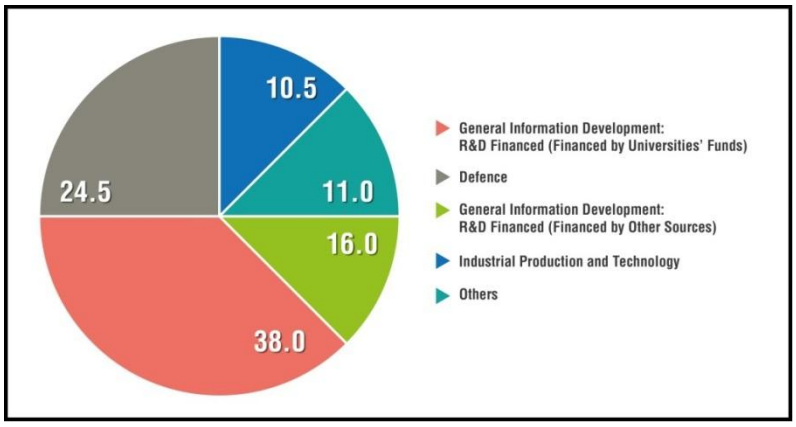
Table 36: *Central Government Budget Appropriations and Outlays on R&D 2008-2014*



Note: **(TÜİK, 2014)**

In line with the TSI news of socio-economic targets, the highest share from the central management R&D budget is allocated for the General Knowledge Development, which finances the university funds. The General Knowledge Development financing the Defence, Industrial Production and Technology, and other resources respectively follow the universities (TSI, 2014). The graphical distribution is shown in Table 37.

Table 37*: Socio-economic Objectives Ratio, 2014*



Note: **(TÜİK, 2014)**

The website of the Turkish Statistical Institute (TSI), it is declared that the aforementioned data is prepared in accordance with the data provided by the Ministry of finance, there is data

showing the level of priority by the government for the R&D studies, and the relevant data is not allocated just for the R&D studies in the governmental institutions and organizations, but for the R&D studies financed by the government in foreign countries (including international institutions) and three national sectors (commercial, non-governmental organizations and higher education).

In accordance with the above clarifications, it can be deduced that Turkey can show possibility to increase to the GII as a result of efficient usage of incentives provided for R&D investments in the next period. On the other hand, as stated before, solely providing incentives and using them in a correct way is not sufficient for creating added value. Political stability must be established; ICT technology infrastructure must be improved; access freedom must be ensured with regulations, access to information must be facilitated in order to create innovation culture, as significant factors explicated thoroughly in the literature part of this study. In addition to access to information, it is further stated in the GII that it is fundamental for Turkey to improve its political stability and develop the legal regulations in positive direction in order to be able acquire Know-hows and forming foreign collaborations. There is a belief that this structuring is not dependent upon governments; having this understanding of structuring as a state policy is indispensable for sustainable development. The distribution of the allocated sources is conducted by KOSGEB, and the Development Agencies provide project support in this field, as well. The supports of the organizations providing major scientific contributions are carried out through the Scientific and Technological Research Council of Turkey (TÜBİTAK) and Turkish Academy of Sciences (TUBA); and these institutions work as the subsidiaries of the Ministry of Science, Industry and Technology.

3.3 **Status Analysis in Turkey and Conclusion**

In order to be able to carry out an assessment of Turkey, the results, which are to be taken from the analysis and discussion sections, are presented in this part of the study.

3.3.1 **Turkey analysis**

Within the framework of TÜBİTAK 2016 strategies, the strong points of Turkey are automotive, machinery manufacturing, and ICT. When the WIPO data is analysed, Turkey takes place in the low and mediocre scale countries category, and she is seen as superior than these countries in terms of producing technological software programs. The sectors which need to gain momentum, on the other hand, are frequently classified as the *defence, space (energy, water, food)* sectors.

It is understood from the graphics in the analysis section that the GII and OECD data are consistent. According to this relevant data, the weak point of Turkey in *political stability/terror, and legal regulations* in the field of *institutions* does impact the general assessment, as well. Even though the *government efficiency* is observed to be a strong point in GII, this feature cannot be qualified as a strong point in real sense, as it is weak in terms of *traditions* and *tendency to creativity in production.*

It would not be wrong to say that *education* and *training*, which is the fundamental compound of human resources, is one of the weakest points of Turkey. When the *scientific outputs* are examined, it striking that although scientific publications increase in number, the citation effect is lessening, and its level of contribution to education is considerably low. The relationship between R&D and education is measured by the R&D personnel with PhD and post graduate levels working in this field. This rate in Turkey is determined to be approximately 20%, and is not sufficient when compared with the world average. Besides, the number of Techno parks, and Spin-offs, which are the interfaces in the technology transfer of universities, is relatively low; and companies in techno-parks are primarily new entrepreneur companies, which creates another problem. Turkey does not have complete legal regulations for the protection of intellectual property rights, and this, in turn, slows down the transfer of knowledge from universities to the industry.

The ICT access rate for Turkey in 2014 GII was observed to be good, and Turkey uses this field mostly for entertaining purposes; the efficient usage of research and other areas is prevalent, but rather weak. According to the WIPO data, in the 2014 GII report, the ICT access rate seems to be at good levels for Turkey, and it is observed that this field is mainly used for entertainment purposes; its usage in research and other fields seemed to be weak. According to the WIPO data, the fact that Turkey ranks first among the less and mediocre developed countries in terms of ICT software reveals the fact that Turkey can improve as regards to the ICT field. One of the aspects Turkey needs to take action is education field, and the QS index criteria analysis results show that it is important to emphasize that Turkey lags behind the countries compared and contrasted.

Turkey has strong power in terms of market development, customs and commerce; it is revealing that Turkey can improve the field of non-agricultural market place. Prioritizing branding, especially increasing the studies focused on becoming a world brand to increase the competitive power will definitely provide Turkey with an advantage. It is observed from the state effectiveness chapter that turkey has positive results from the indexes. When looked from the perspective of the developing countries, the supports must efficiently be used for the companies and institutions, and university researches having objectives of branding, and this will help reach the targeted objectives.

In this context, in order to increase the efficiency of the information outputs, it becomes an obligation to incentivize the patent and brand applications, in which Turkey ranks the last among the countries compared and contrasted. Turkey considerably lags behind in the *product creation* and *brand production*, which are among the important criteria for innovation; it can be stated that investments in this field must be supported, on the basis of the data provided in the analysis and discussion chapters. Although Turkey is successful as regards to the relevant field in the culture exportation, the fact that sub-fractions are weighted as tourism institutions such as

restaurants, and hotels; and these institutions will show variability depending on the political stability/terror development in the relevant category, which is why regulation is obligatory.

When the Turkish education graphics are analyzed, the strong points are seen as the increasing number of post graduate and PhD students, scientific outputs, and increasing number of citations. Increasing the amount of government incentives for the transferring of all these into the R&D and establishing relationships will definitively increase the number of innovative studies and successful and innovative approaches in the ecosystem. It was stated in the discussion chapter that the state endeavors to increase the number of incentives in order to increase the amount of recruitment of full-time R&D personnel in the universities through the Ministry of Science and Technology. Actualization of planned and regular incentives over real figures is a phenomenon that will support innovative development ultimately.

The insufficiency of Turkey in the field of innovation policies is one of the striking results emerging in the literature scan and analysis chapters of the thesis. Instability in the R&D policies, and legal deficiencies in the technology regulations, is of significant obstacles. Scientific outputs, increasing quantitatively, but decreasing qualitatively, are creating hurdles in the development of the technology and innovation system and growing human force based on information.

The criteria interpreted in this chapter impact the entrepreneurship rates directly or indirectly, and lead to the fact that Turkey's venture fund is zero in the relevant charts. Even though the number entrepreneurs are high, there is no information about the venture fund in the relevant data.

Empowering Turkey's innovation ecosystem and paving the way for being effective in this field, there must be a road map peculiar to the country. The analysis conducted indicate that other countries have determined their strong fields, and taken action on the basis of determining the route the world is going through. Within this framework, the modelling, which is to be

actualized by Turkey, shall be carried out without rupturing from the world, and through realistic analysis, determining the country's own shareholder's equity, and prioritizing the studies and projects to efficiently use the communication channels in order to be able to establish cooperation between the actors in the ecosystem.

3.3.2 Analysis and evaluation of the discussion chapter

It has been observed from the comparison and contrast conducted that countries have determined their superior fields and penetrated into the targeted markets considering their own dynamics. Along with that, the world conjuncture is taken into consideration and the relevant countries advance through R&D activities oriented towards the market gaps, which their production can fill up. It is striking that scientific studies, sector analysis, legal regulations and company incentives are important in terms of composing strategies. Countries study and work for their objectives on the basis of their particular models and strategies; they allocate certain amount from their GDP to the R&D studies and activities; and show sensitivity as regards to the incentives, updating according to the conditions of the day when deficiencies are seen in the legal regulations of the university-industry cooperation.

It is also observed that studies carried out by the universities have taken a route to specialization and they provide contribution to the industry, and create added value to the country's economy; the legal frameworks of the spin-off structures are determined to the aforementioned end.

The fact that industry started carrying out the fundamental and practical R&D activities over scientific institutions broadened the framework of the cooperation, and this is shaped through the win-win model.

States support the collaboration of universities and industry through regulations and incentives, and follow up a consistent attitude. In addition, they exhibit openness to the international cooperation, and offer the know-how that is in the hands of the foreign companies they attract to the homeland. Legal regulations about the intellectual rights gained importance, and it is

understood that the intellectual property rights will give rise to studies that will decrease or even eliminate the unease of the companies in national and international levels. It is obvious that it has become easier for the countries, which are members of international brands and patent organizations, to follow up the world market in order to be able to advance themselves.

China's data, among the countries compared and contrasted, can be shown as an exemplary data. When becoming a member to the WIPO, China created intellectual property rights regulations through the *Open Door Policy* approach, and there has been a change in the production and services sections. In addition, China has its place among fast-developing countries with her studies and works conducted. Another feature of China is that China completed the intellectual property rights protecting the homeland companies' rights and competitive advantages before attracting foreign investors to the country. Similarly, it is declared in the chapter *the Importance of Intellectual Rights* that Korea followed up the same route as China.

It can be seen from the analyses in the indexes that the countries' creation of *economic added value* is connected to social life. Categories such as *institutions, state effectiveness, violence/terror in the country, human rights, freedom of press,* and *government stability* are present for *value creation* for innovation category; and these points are taken into consideration when measuring is conducted. The reason for this is that, innovation develops through international level cooperation, and country stability constitutes major part of this integration. There is a necessity for freely thinking and creative individuals, and institutions and organizations promoting global level of cooperation in order to be able to create an innovation ecosystem. Furthermore, this can be achieved through creativeness, following up the world market, and challenging studies which become meaningful when turned into product/service and brand.

As a consequence, it is necessary to have governmental regulations and policies, settle a legal framework and take steps to contribute to the establishment of an innovation ecosystem for the branding of the R&D studies to create new product/services through legal regulations scoping the collaboration between universities, state and industrial enterprises. It becomes an imperative necessity to allocate certain amount of the budget of the industrial activities to the R&D analyses that will ultimately create a certain level of innovation. Along with that, in addition to the education and training missions of the universities, they need to provide support for the companies, and spin-off firms through human resources, technology transfer and other kinds of interfaces; by means of these interfaces, they need to have a *entrepreneur university* structure, which has activities that will create added value to the economy and opportunity for collaboration with the industry, which is of great significance in terms of competitiveness under today's circumstances.

3.3.3 **Model proposal for Turkey**

Countries yearning for taking place permanently in the global market competition need a model particular to their countries, as declared in the literature scan part of thereby study. Today, development of an economy based on information with the *Triple Helix Model* can be measured on the basis of the actors of the model and the roles they undertake, the relations the actors form with each other and impact level of the R&D studies and their contribution to the country's economy.

The difference of the *Triple Helix Model* from the other models is uttered to be the horizontal and vertical interaction of communication levels and paving the way for creating a socio-economic difference. Along with that, the complex structure of the relations network further complicates the process of measurement; however, the model constitutes the measuring algorithm, as well. Measuring the countries' development and growth on the basis of certain criteria is of great importance in terms of revealing the added value created by countries. In this

context, an R&D model, based on the general assessment of Turkey depending upon the data provided in the analysis and development chapters, is endeavored to be offered. Countries establishing their innovation models before Turkey and coming to the forefront with their innovation models and productions in the world market and make progress and Turkey are compared and contrasted in the analysis chapter of this study. It is among the comparison criteria that these countries may well be exemplary to Turkey for an innovation model.

The fact that the European market is on the way opening to Middle Eastern and Far Eastern markets is the most crucial factor Turkey receives from her history. Turkey has a geopolitical structure which can be used for the development of the country; in addition to that, innovation strategy and policy which is developed through the efficient evaluation of the country's resources shall be shaped as long-term state policies. Governments shall undertake the duty of facilitating the sustainability and development of the created innovation system, providing solution to the problems encountered, and auditing the system and eliminating any malfunction. Furthermore, governments shall determine the short and long terms objectives for innovation on the basis of the state policies, create strategies in order to be able to reach these objectives; create alternative plans as regards to preventing the possible malfunctions when proceeding through the attaining the objectives. When the successful country examples are scrutinized, it becomes obvious that innovation systems provide benefit when they are within the state policies. In other words, the government shall not have radical changes in the innovation infrastructure based on the state policies and innovation strategies; rather, the Ministry of Science and Technology shall carry out the updates for the changing conditions of the day with alternative plans and unforeseen situations in line with the pre-determined objectives, which is of great benefit. Besides, the PDCA (Plan-Do-Check-Act) circle shall be carried out on the basis of data in all fields; developments and malfunctions must always be followed up and sustainable development must always be encouraged.

University-Industry-State cooperation structure should carry qualifications peculiar to the country in the shape of a DNA spiral, and designed to renew itself continuously. *A model proposition for Turkey* is provided in Figure 15.

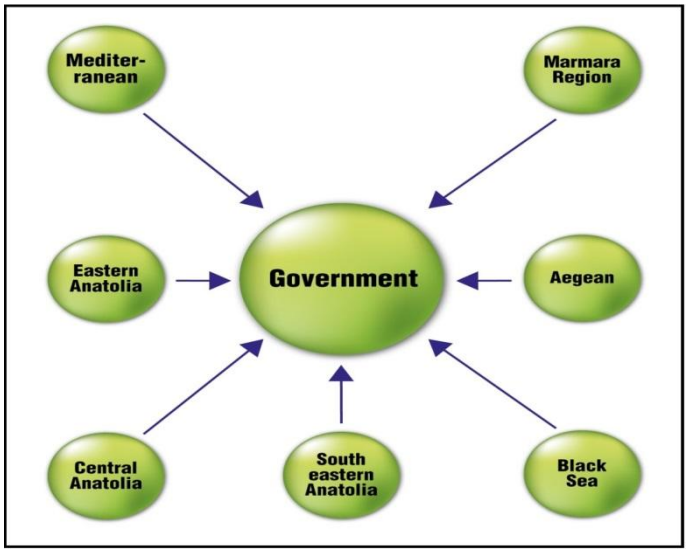


Figure 15: *A model proposition for Turkey*

University-Industry-State cooperation exhibits a multi-layered structure. When state policies are determined, the objectives and strategies must be structured on regional and global scales. Regulations to be carried out in the state incentives and funds will provide increasing venture fund, only if they are supported through prioritizing cooperation with the relevant entities. In addition, incentives must be sustainable in order to be able to create R&D and innovation climate; commercialization and returning of each of the incentives must be followed up on the basis of the relevant data. As a result of the systematic follow up of the returns, a rewarding system that will provide advantage for the companies must be constituted.

Domestic partnerships must be planned and infrastructure that will support their organizations must be created in order to be able to attract foreign capital to the country through Investment Agencies to develop the short-term R&D and innovation climate. In order to be able to support the partnerships; political, social and economic structuring will only be possible through completion of legal regulations. Therefore, it is essential to determine the sanctions in the

implementations of followed systematic and organized technology and innovation policies and establish stability in the country in order to turn the short-term objectives into medium and long-turn objectives.

Implementations to be carried out as regards to the regional objectives in the creation of university-industry cooperation and advancement shall be undertaken by the Development Agencies. The reason for this is that the Development Agencies, which are half state - half NGO organizations, have the capacity by this means to audit, collect data and keep reports at regional level; and this can provide the opportunity to measure the added value created in the country through the feedbacks submitted by these organizations to the Ministry of Science, Industry and Technology at regional basis.

It is necessary for the centers producing information be structured in a way that will contribute to the commercialization of information through state incentives. In this sense, in addition to the European Union funds, giving institutions and organizations working for the commercialization of products/services by turning them into products/services with high added value at the level of contribution by the public and private universities to the industry additional support and incentives for their projects is important as regards to make the relevant endeavors sustainable.

In this sense, the state must be the observer as regards to achieving the objectives in line with the innovation policies. Furthermore, the state must adopt an approach of organizing, following up the strategies, and providing solution. A country's competitive capacity in the global basis is measured through the rate of its market share of products with high added value; the fundamental innovation infrastructure must be robust and sustainable in order to be able to have increasing export figures and product/service branding. At the same time, the state, as a political institution, is responsible for providing a trustworthy economic environment when constituting the country image or country brand, including internal security. Besides, developments must be followed and monitored continuously on the basis of the regional objectives; and works to

improve skills in order to carry out R&D studies and innovations that will take place in global scale with a holistic perspective must be supported. In this context, the regional structuring proposed for Turkey is presented in figure 16.

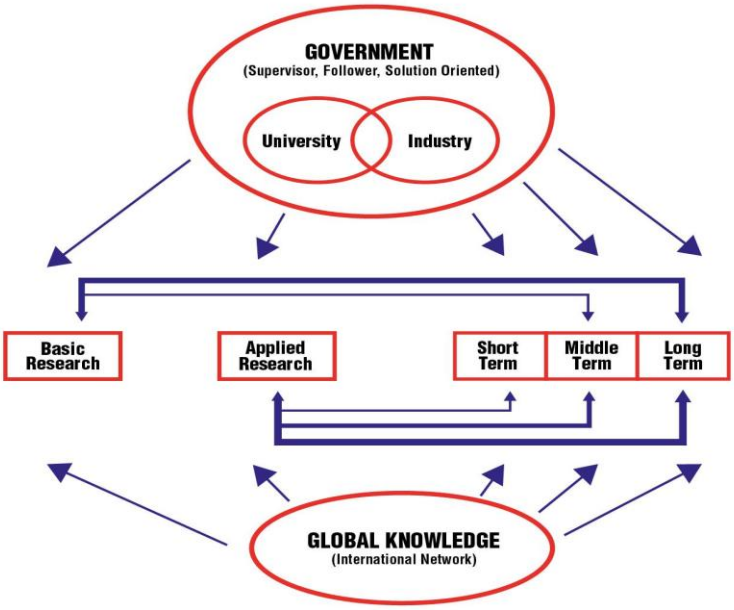


Figure 16: *The Regional Structuring Proposed for Turkey*

The regional structuring model is designed as the *star model*. Considering the fact that Turkey's seven regions have different and unique features; peculiar resources of the regions (ground and underground raw materials, human resources, regional structure, etc.) shall be divided into sectors such as food, energy, and defense; and these sectors shall be thought as centers in which R&D and innovation studies can be carried out. *Entrepreneurship* shall be regulated in a flexible way that will support the efficiency of the regional resources. Resources which are to be transferred from Small and Medium Industry Development Organization (KOSGEB) and EU projects aim at creating a result-oriented approach and facilitating joint studies with universities and industry in regional basis with organizations such as business incubators, technology transfer offices, and techno-parks of the granting systems for generating venture fund and crediting result-oriented studies.

Taking the *triple helix model* of these centers into consideration, it is planned that institutions producing information and industrial organizations shall take place in the region and provide the necessary conditions for production and organize legal regulations and incentives through the state. As a result, regional development is being planned, and it is projected that the country's economy will be developed with products of high added value.

In order for the regional development have sustainable impact on the R&D and Innovation climate, the incentives return and commercialization success must be measured and followed up. For this follow up and commercialization; data must be collected and regulated, and the extent to which they turn into products with high added value; later, institutions and NGOs producing information must submit reports to the Ministry of Science, Technology and Industry, the original mission of which is auditing, in order to create the criteria for incentive system. In other words; the development agencies have the task of systematically structuring the cooperation between the universities – institutions producing knowledge –, and institutes, and social organizations; providing and supervising knowledge production supports, and measuring the amount of added value created.

Studies and works conducted to commercialize the products to the market from institutions, where fundamental and practical research is generated, to the market will facilitate the prevalence of the products countrywide in *the star model*, and legal regulations to increase the knowledge transfer from the highly competitive companies.

Restructuring the education system is of great importance as regards to the cooperation between the relevant entities. Starting from the first education, creating an education model that is encouraging creativeness and contributing to the knowledge production is another field for which the institutions within the government must cooperate. These changes that are to be carried out in the elementary schools must be designed holistically, and this holistic and target-oriented structure of the education institutions must be continued until the university, masters,

and PhD studies. In this context, it is obvious that it is necessary to plan the education system in a way that it is encouraging creativeness and far away from memorizing. Starting from the middle school and high school, the students shall be educated in a way that they will create added value to the industry in line with the abilities and skills of the students. Determining the students' abilities and skills shall be added to the scope of the task definition of the guidance counselors in Turkey. There is a need for a new education system that will allow cooperation with the industry in line with the feature-oriented career plans shaping according to the needs of the country. The Ministry of National Education, Board of Higher Education and the Ministry of Science, Industry and Technology should arrange a common workshop; and determine the workers' profile needed in the country in line with the innovation targets of the country. Investing in the personnel that is needed/may be needed in line with this objective will definitely contribute in the development of the country.

Universities must be restructured to be researcher, productive and multi-disciplinary in line with the *third generation universities* remarked by Wissema. University instructors shall not be just the personnel transferring the knowledge, they should create practice fields of the relevant knowledge; they should act with a pathfinder approach and assess the project practices of the students, they should encourage interactive studies within the system. Along with that, not just TÜBİTAK (Scientific and Technological Research Council of Turkey) but the universities' administrative staff should allocate budget to the studies that will contribute to the international networks and organizations' technology offices. Companies conducting R&D studies with the incentives and carrying the projects to success shall be supported with tax discounts in the period following the project, thereby; particularly small and medium size companies shall be supported to carry out innovation studies (Piketty, 2014).

It is possible for the universities to transfer knowledge to the industry if they are supported by the technology transfer offices, business incubators and spin-off company structures.

Fundamental and practical researches will facilitate the efficient use of these centers, for sure. Moreover, in order to increase the competitive power of the companies in the sector, leader education programs should be regularly transferring knowledge to the organizations and this will ease up monitoring the world market.

Education centers should be organized by the research institutions of the universities or government institutions. In the context of the proposed Turkey model, education centers can be structured through the organizations formed in the regional, national, and international platforms.

As a result; education system plays an important role in the constitution of the sustainable innovation ecosystem. The structure of the education institutions, where knowledge is produced, is of importance in the structuring of the innovation climate in line with the country objectives.

Each country must determine its primary fields when creating the innovation climate, and carry out their studies systematically. In this framework, when the R&D sector intensity in the Turkey assessment chapter of this study is examined; the rates are ranked as automotive and automotive sub industry is 51%, ICT and software 22%, drug and chemistry 19%, defense industry 11%, electronics 11%, machinery and equipment 10%, durable consumption goods 8%. Sectors such as food, energy, aviation and petrol products, on the other hand, have the lowest rate; however they show indications that they are fields having the potential to be improved. Even though construction industry does not take place in the R&D activities, it is observed that the glass ceramics sector has a 3% share in the R&D activities.

It is essential for Turkey to determine her sectors to be improved in line with the above information. In light of this information, it will be beneficial to divide the areas in which Turkey is most successful and has potential to improve in regions on the basis of certain sectors. Sectors structured regionally should be supported by the universities and knowledge-

producing institutions within the regions. In this sense, the regional divisions of the sectors are presented below:

Automotive and Textile Industry: Marmara Region, Southeast Anatolia

Agriculture and Food Industry: Marmara, Mediterranean, Central Anatolia, Black Sea, Aegean

Livestock: East Anatolia

Mining: Aegean, Western Black Sea, Southeast Anatolia

Energy: Black Sea, Mediterranean, Aegean, Marmara, East Anatolia, Southeast Anatolia, Central Anatolia

Tourism: Black Sea, Mediterranean, Aegean, Marmara, East Anatolia, Southeast Anatolia, Central Anatolia

4 CONCLUSION

As a result of the rapid technological developments gone through after the Industrial Revolution the ICT technology developed, and both the social and economic structure turned out to be based on information. The transformation that has been gone through all over the world paves the way for the changes in the economic structures, political life and even socio-cultural life within the countries. It is an accepted phenomenon that the political and social conditions of the countries reflect their innovation strategies. The criteria of the international institutions such as OECD, WIPO encompass these phenomena.

Today, the socio-economic developments of the countries are named after *information age*, and it is not possible to stay out of global developments today. Innovation has an important place in today's economy. There has been a transition from giant factories to offices, working conditions ways have changed together with the ICT, and the women's contribution to economy have considerably increased. It has been uttered that being bindingly creative, innovative, productive and sensitive to environment has been the reality of the century. It has been determined that economy can gain force through the natural resources, powerful human resources, creativeness, technology, sustainable innovation system and network structures. Carrying out innovation can only be possible through confirming to the abovementioned system.

Creating and measuring innovation, constituting and auditing data, producing products and services that turn into added value are all actualized through the university-industry cooperation. National networks are not sufficient to that end. Therefore, network systems are empowered by international networks. Knowledge transfers will shape the innovation activity in a healthy way through the active usage of these structures. Determining the innovation strategies and regulating them as state policies is a crucial element for the innovation system.

In this context, when the Turkey and other countries' comparison on the basis of the GII indicators are examined, it can be deduced that the country's potentials are revealed and the direction of the innovation studies are determined. The fields in which Turkey is strong, on the other hand, can be improved through a model via denoting these fields as open to support.

The fact that Turkey is weak in terms of *political stability/terrorism, legal regulations and freedoms* creates problem in attracting foreign investors and multinational companies to the country. In order to encourage these countries to invest in Turkey, the relevant fields and legal frameworks must be completed. Technology transfers that can be done from the multinational companies are of great importance as regards to creating the innovation infrastructure of the country. Along with that, creating international cooperation will contribute to the education field and economic development of the country, therefore the country stability, state policies and intellectual property rights will be protected through completion of the legal regulations, which will ultimately create economic added value.

Insufficient number of citation in the scientific outputs, universities' low level of success in the QS indexes are among the aspects of Turkey which need to be advanced. The course intensity of the lecturers in the country causes the problem of not allocating enough time for the researches to be conducted. As the publications to increase seniority do not increase the number of citation; the faculty members' researches, projects, and studies oriented towards the industry shall be supported, which will be facilitating efficient use of potentials. In order for the master and PhD degree students find a more appropriate study environment in the R&D and industry, the companies within the industry and services sector should be incentivized and encouraged. The analysis of the relations between R&D and education results in the fact that the number of R&D personnel, and post-graduate personnel should be increased in Turkey. Studies and endeavors to encourage the post-graduate and PhD graduates to work in the R&D area should

be taken into consideration when creating and establishing an innovation model, as important elements. Turkey's education model and potential should be structured in a way that facilitates works in this field. Establishing an education and training system that will increase creativeness from the primary school will facilitate the efficient use of the resources of the countries, which has young population in the field of human resources.

Therefore, galvanizer approaches must be adopted in order to develop in the field of *education training*, which is one of the fundamentals of the innovation system; and state policies must be regulated in order to fulfill the expectations of the universities and industry.

One of the criteria within the innovation system is *entrepreneurship* and *venture fund*. Although the number of entrepreneurs in Turkey is relatively sufficient, it is striking that the amount of venture low is little, if any. Augmentation of the venture capital cannot be realized without political stability and legal regulations. It creates a problem not to collect data within the country to measure the extent to which the incentives are turned into products/services with high added value. Notwithstanding that, Turkey is perceived to have the potential to produce software technology to collect and statistically assess the data.

In addition to technological investments, Turkey has prolific agricultural lands and irrigation capacity; and can increase her investments in agricultural field to solve the projected food crisis in the future. It is essential to provide support for the seed warehouse projects and organic agriculture, and use the country land productively. Faculties of Agriculture of the universities must carry out seed improvement and increase the fruitfulness of the natural products. Besides, pasture areas must be rearranged and development of the husbandry sector in a way that would contribute to the country's economy must be facilitated as essential projects. Agricultural products constitute the major part of China's exportation.

Another aspect that Turkey can improve is *brand creation* and *patent*. In order to actualize this, primarily the intellectual property rights must be guaranteed under the constitution within the

country, compared to the other countries compared and contrasted. When countries developed as regards to the innovation field are scrutinized, it can be observed that the intellectual property rights are arranged according to the day's conditions, yet are executed as state policy with constitutional guarantee. Turkey renewed the patent law, they adopted in 1879 without adapting, in 1995; although new patent law draft was prepared in 2013, there is not much advancement as regards to this issue, yet. As numerous global changes have been gone through in patent and brand applications as of 1995, legal regulations have an immediate importance in terms of the innovation system of the country. In that, although the number of Turkey's patent and brand applications has increased over time, it can be said that it is not sufficient; the foreign companies within the country give more importance to these issues rather than the domestic companies.

It is necessary to evaluate the conditions of Turkey impartially, and find the most appropriate road map for the country's infrastructure in order to structure Turkey's innovation ecosystem and be successful. The examinations carried out in this field show that successful countries have determined their strong points, follow up the developments in the world and create plans on the basis of the short-medium-long term projections of future. In this context, it is important for Turkey to establish her model through following up the world conjuncture with realistic analysis, adopting their shareholder's equity and using the communication channels efficiently to create cooperation between the actors within the innovation ecosystem. It is a must to determine the models in accordance with the structure of the country without forgetting that innovation is a long way to go.

In the thesis, a star structuring was proposed on the basis of the World and Turkey analysis, GII, OECD and WIPO; and the Swedish model, in which state is comprehensive, is taken into consideration as the innovation model. The relevant model complies with the 'Statism

Principle' of Turkey, and is not a foreign practice to the previous economic plans; therefore the model has a scheme that can easily be adapted to the features of the country.

It is underlined in the proposed model that the innovation system must primarily be taken as a state policy. Considering that Turkey has seven regions and each and every region has its own peculiar resources, there must be a convenient sectorial division. Turkey's problems in the University-Industry-State cooperation were examined, and distribution of tasks was carried out accordingly in the state institutions, quasi-state institutions, education institutions and NGOs. It is objected to provide contribution to the venture fund within the ecosystem by the Development Agencies which are quasi-state institutions and have regional structures. The tasks of auditing and reporting the financial supports such as grants and credits that are to be provided because of the regional structures of the relevant institutions are given.

The tasks of supporting the industry and university cooperation as a state policy are planned as; organizing workshops to sustain the projects that are contributing to the long term plan in line with the reports, which are to be submitted by the NGOs and Development Agencies to the Ministry of Science, Industry and Technology, Ministry of National Education and Higher Education Council; and establish support and sanction systems that will allow checks and balances for the incentives.

With the purpose of structuring the education and training system in a way that is oriented towards the practical implementations and maintaining continuity the joint works of the Ministry of National Education and Higher Education Council pose importance. It is necessary for the two institutions to act collaboratively in order to transfer creative brains with high potential of research from the middle school to the university level to the industrial sectors and conduct future-oriented studies. Students which are to enroll in the high schools, Vocational High Schools or universities should have internalized and practiced the knowledge they acquire from the institutions affiliated to the Ministry of National Education; and this has paved the

way for the assessment of the factors impacting the quality and quantity of the future undergraduate and PhD students. In addition, countries which are successful in innovation have gone through changes in their education systems, and prioritized qualifications, the fact which is presented in literature scan of the USA and Germany comparison in terms of the transition of universities.

In this context, it is necessary to shape education in line with the implementation and creativeness studies, and the state must get involved in the innovation policies. Along with that, public and private institutions producing knowledge should carry out joint projects with the industrial companies in their regions; and the Development Agencies must facilitate information transfer formally and informally, as determined clearly in the proposed model.

Another problem for Turkey is that there is not any system through which the results of the incentives for production and product development can be monitored. In this relevant model, it is considered to give the task of collecting data for measuring the impact of the funds and incentives provided by the government on the added value to the Development Agencies which are regionally authorized.

The task of working on reflecting the statistical data acquired by the Turkish Statistical Institution, which is a governmental institution, from the Development Agencies, on the tax discounts, on the other hand, is projected to be submitted to the cooperation of the Ministry of Finance, Ministry of Science, and Technology and Industry. If universities realize data storage and analysis software with the incentives by TÜBİTAK, that will contribute to the studies and projects, in general.

In the Turkish Model, the task of incentivizing the primary areas in the scientific institutions is considered to be submitted to TÜBİTAK and TÜBA. Along with incentivizing increase in the number of scientific publications, awarding the publications entering into the citation index will encourage academic studies of high quality.

Models and developments belonging to the innovation ecosystem taking place in the literature are historically analyzed for Turkish models. The last government explicated Turkey's objective as *"being one of the first five economies of the world"*. On the route to attain this objective, the economic developments were chronologically presented in the literature part in order to be able to scrutinize Turkey's conditions of competing in the global market. As innovation strategies have an important place in the world market, the innovation models and university-industry-state cooperation are examined. Successful countries, which have established their innovation strategies beforehand, s determined in the analysis and discussion chapters have been compared and contrasted with Turkey on the basis of the data collected from the GII, OECD, and WIPO and the results were thoroughly assessed. In line with the results of these analyses, Turkey's situation was determined and the areas in which Turkey would improve were detected, as well. Depending on the Triple Helix Model, a study proposing a model for Turkey was explicated on the basis of the literature, analysis and discussion chapter of the thesis.

It should not be forgotten that innovation is a long-term work and only one of sixty of new ideas can be successful by taking lessons from the failures. Information transfer bears an important place in the triple helix model. Therefore, interfaces such as technology transfer offices, techno-parks, and business incubators must be utilized in order to turn the information that is to be transferred from university to the industry and from the industry to the university into products/services of high added value.

Sensitive approaches to the utilization of the spin-off structures of the techno-parks in Turkey will definitely assure efficient use of the existent potential.

Along with that, it is important to create and complete the legal frameworks of the intellectual property rights on the basis of the expert views in order to be able to acquire know-how from the foreign companies. In addition, it is important to activate the areas which will immediately

provide solutions for the political stability/terror issues of Turkey. One of the successful areas of Turkey is tourism and service sector. Regulating the criteria of freedom in terms of the political stability/terror issues in Turkey will make possible development in this field and attract foreign investments to the country.

Even though a model is proposed for the national innovation, efficient running of this system -which is dependent upon the triple helix model-, will not be possible without being connected to the international networks and information channels, as stated in the model proposition analysis. Turkey has the features that will carry the country to success such as population properties, geopolitical structure, being on the routes of commerce and trade and having vast amount of variable resources, if the resources are managed to be used in a systematic way. Turkey has the capacity for using the resources owned by the country systematically, monitoring the data through assessment and taking steps forward via the lessons to be taken from failures.

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APPENDIX A: Comparative GDP in R&D Investment Ratio & Investment Amounts

	GERD as a percentage of GDP				
	GERMANY	**USA**	**S.KOREA**	**CHINA**	**TURKEY**
2000	2,47	2,62	2,30	0,90	0,48
2001	2,47	2,64	2,47	0,95	0,54
2002	2,50	2,55	2,40	1,07	0,53
2003	2,54	2,55	2,49	1,13	0,48
2004	2,50	2,49	2,68	1,23	0,52
2005	2,51	2,51	2,79	1,32	0,59
2006	2,54	2,55	3,01	1,39	0,58
2007	2,53	2,63	3,21	1,40	0,72
2008	2,69	2,77	3,36	1,47	0,73
2009	2,82	2,82	3,56	1,70	0,85
2010	2,80	2,74	3,74	1,76	0,84
2011	2,.89	2,76	4,04	1,84	0,86
2012	2,98	2,79	4,36	1,98	0,92

NOTE: *GDP in R&D Investment Ratio it was prepared with data (Data extracted on 23 Jan 2015 07:29 UTC (GMT) from OECD.Stat* (OECD)

	GERMANY	**USA**	**S.KOREA**	**CHINA**	**TURKEY**
2005	$977.131.972,00	$904.339.487,22	$284.418.167,17	$761.953.409,53	$63.120.948,80
2006	$1.121.962.887,00	$1.037.029.245,26	$325.457.247,33	$968.935.601,01	$73.476.408,14
2007	$1.328.841.354,00	$1.162.538.149,77	$371.477.103,60	$1.220.059.601,01	$85.534.675,52
2008	$1.466.137.413,00	$1.299.898.877,21	$422.003.479,07	$1.430.693.066,08	$132.002.384,61
2009	$1.127.839.933,00	$1.056.712.078,25	$363.531.063,38	$1.201.646.758,08	$102.138.525,69
2010	$1.271.096.328,74	$1.277.109.161,89	$466.380.619,66	$1.577.763.750,89	$113.979.451,83
2011	$1.482.202.274,32	$1.479.730.168,89	$555.208.897,97	$1.898.388.434,78	$134.915.251,95
2012	$1.416.184.199,21	$1.545.565.185,67	$547.854.448,00	$2.048.782.233,08	$152.536.652,60
2013	$1.458.646.977,78	$1.578.001.361,90	$559.618.558,90	$2.209.007.280,26	$151.796.483,76

NOTE: *Comparative GDP in R&D Investment Amounts. http://wits.worldbank.org/, 23.02.2015 it was prepared with data* (World Integrated Trade Solution)

APPENDIX B: Table of Value Added in Gross Export by Source Country and Source Industry

Value added in gross exports by source country and source industry					
Germany					
	1995	2000	2005	2008	2009
TOTAL	**541.856.312**	**545.566.032**	**973.060.938**	**1.456.998.043**	**1.159.443,49**
Agriculture, hunting, forestry and fishing	8.605.174,00	7.939.321,00	10.509.802,00	17.450,87	12.514.001,00
Mining and quarrying	11.955.886,00	14.534.644,00	34.330.459,00	68.170.267,00	45.132.421,00
Food products, beverages and tobacco	8.877.753,00	8.333,60	16.254.259,00	23.073.416,00	15.454.421,00
Textiles, textile products, leather and footwear	8.157.914,00	6.886.523,00	9.168.764,00	9.075.572,00	6.374.937,00
Wood, paper, paper products, printing and publishing	21.162.257,00	22.476.883,00	34.410.532,00	46.447.964,00	33.162,64
Chemicals and non-metallic mineral products	71.268.916,00	67.982.363,00	111.832.932,00	157.400.012,00	116.521.533,00
Basic metals and fabricated metal products	49.513.691,00	46.101.814,00	85.143,19	127.723.411,00	96.394.915,00
Machinery and equipment, nec	47.331.829,00	40.483.116,00	70.148.675,00	122.231,85	97.104.474,00
Electrical and optical equipment	42.936.151,00	47.626.926,00	77.731.896,00	92.358.671,00	69.670,65
Transport equipment	46.601.452,00	45.308.493,00	83.375.683,00	15.505.469,00	71.567,68
Manufacturing nec; recycling	4.719.906,00	5.194.807,00	8.539.152,00	15.504.469,00	11.509.257,00
Electricity, gas and water supply	12.076.251,00	9.565.202,00	24.853,15	34.103.199,00	27.971.383,00
Construction	5.291.125,00	3.824.749,00	6.506.132,00	8.922.459,00	9.079.332,00
Wholesale and retail trade; Hotels and restaurants	47.556.793,00	53.234.862,00	87.746.189,00	151.115.602,00	122.876.502,00
Transport and storage, post and telecommunication	43.093.587,00	44.128,83	81.204.402,00	117.608,89	95.145.012,00
Financial intermediation	22.335.025,00	18.221.612,00	31.507.179,00	50.329.783,00	43.105.325,00
Business services	77.882.753,00	90.397.928,00	173.820,65	268.339.731,00	240.694.474,00
Other services	12.489.878,00	13.324.359,00	25.977.891,00	53.595.861,00	45.164.804,00

NOTE: *http://stats.oecd.org on 02.02.2015 it was prepared with data*

Value added in gross exports by source country and source industry					
Korea					
	1995	2000	2005	2008	2009
TOTAL	**145.730.326**	**198.986.865**	**320 882.121**	**475 578.155**	**401 162.434**
Agriculture, hunting, forestry and fishing	4.395.459	3.500,42	11 236.074	5 086.628	4 756.226
Mining and quarrying	5.618.332	15.392.591	30 675.129	72 564.277	47 781.887
Food products, beverages and tobacco	1.399.452	1.740.962	2 676.943	2 497.552	2 485.203
Textiles, textile products, leather and footwear	10.578.118	10.582.197	7.425,43	7 005.804	6 596.176
Wood, paper, paper products, printing and publishing	3.699.331	4.071.081	6 019.538	7 332.758	7 033.134
Chemicals and non-metallic mineral products	18.099.116	24.963.054	44 088.363	57 078.073	42 585.223
Basic metals and fabricated metal products	11.232.884	14.636,96	27 170.537	43 811.569	32 978.681
Machinery and equipment, nec	4.849.188	6.282.053	10 405.933	16 472.906	15 761.793
Electrical and optical equipment	23.587.361	34.166.566	43 917.472	61 243.98	52 211.997
Transport equipment	7.835.194	9.720.695,00	17 555.972	31 939.641	26 475.334
Manufacturing nec; recycling	1.186.075	1.555.002	2 965.723	4 196.955	3 395.751
Electricity, gas and water supply	2.846.499,00	4 151.963	6 817.021	6 811.488	7 851.228
Construction	577.261,00	744.209	912.465	1 384.591	1 531.406
Wholesale and retail trade; Hotels and restaurants	14.073.089	20 862.274	29 060.19	39 773.008	39 691.643
Transport and storage, post and telecommunication	13.850.321	17 864.349	31 212.978	48 760.998	41 197.683
Financial intermediation	6.688.776	8 558.686	12 472.92	17 821.771	16 572.962
Business services	13.134.134	17 746.358	31 753.705	45 909.59	46 715.345
Other services	2.070.735	2 447.444	4 515.728	5 886.564	5 540.761

NOTE: *http://stats.oecd.org on 02.02.2015 it was prepared with data*

Value added in gross exports by source country and source industry					
Turkey					
	1995	2000	2005	2008	2009
TOTAL	**37 848.466**	**50 847.506**	**99 872.305**	**164 736.999**	**136 407.229**
Agriculture, hunting, forestry and fishing	3 074.131	2 894.112	5 393.626	7 088.019	6 993.41
Mining and quarrying	1 075.18	1 274.369	3 979.718	11 414.012	8 434.639
Food products, beverages and tobacco	1 322.019	940.681	1 708.305	2 647.373	2 228.097
Textiles, textile products, leather and footwear	4 935.23	6 418.708	11 003.467	13 756.295	11 062.832
Wood, paper, paper products, printing and publishing	606.891	876.739	1 882.4	3 021.521	2 374.323
Chemicals and non-metallic mineral products	3 569.145	4 347.636	9 188.96	15 667.111	11 985.278
Basic metals and fabricated metal products	2 196.094	2 326.558	7 453.482	16 802.088	11 488.555
Machinery and equipment, nec	511.811	871.601	2 702.657	4 885.068	4 524.623
Electrical and optical equipment	651.335	1 185.062	2 855.968	3 882.551	3 540.248
Transport equipment	604.468	1 511.519	5 755.382	9 341.765	7 050.887
Manufacturing nec; recycling	288.924	330.148	854.319	1 373.12	1 069.589
Electricity, gas and water supply	757.05	867.697	1 896.606	3 926.814	3 544.23
Construction	55.7	1 128.129	1 750.375	1 995.913	2 370.785
Wholesale and retail trade; Hotels and restaurants	6 255.427	7 851.884	14 494.456	24 092.565	19 756.158
Transport and storage, post and telecommunication	7 014.307	8 844.341	15 859.352	22 941.659	19 073.922
Financial intermediation	2 026.378	4 757.264	4 629.913	7 471.509	7 698.757
Business services	2 030.589	2 851.523	5 748.49	10 462.879	9 887.227
Other services	873.786	1 569.535	2 714.827	3 966.737	3 323.671

NOTE: *http://stats.oecd.org on 02.02.2015 it was prepared with data*

Value added in gross exports by source country and source industry					
USA					
	1995	2000	2005	2008	2009
TOTAL	**774 073.75**	**1 029 512.881**	**1 203 129.444**	**1 712 638.91**	**1 458 182.778**
Agriculture, hunting, forestry and fishing	25 966.514	18 864.673	23 737.902	43 610.544	35 497.921
Mining and quarrying	34 118.738	19 593.385	46 113.207	135 630.03	73 578.346
Food products, beverages and tobacco	17 800.419	12 918.408	15 010.306	24 193.529	25 675.68
Textiles, textile products, leather and footwear	11 859.487	17 468.262	17 475.414	13 003.924	9 286.94
Wood, paper, paper products, printing and publishing	41 029.277	38 459.069	42 106.143	53 376.131	51 029.918
Chemicals and non-metallic mineral products	79 102.298	80 215.922	120 646.717	181 107.266	162 808.709
Basic metals and fabricated metal products	49 589.933	63 530.105	79 175.205	125 214.273	77 122.349
Machinery and equipment, nec	41 919.287	45 466.168	49 132.996	62 443.872	54 416.465
Electrical and optical equipment	103 549.796	210 745.491	146 552.164	165 748.986	139 269.149
Transport equipment	41 111.005	52 389.399	72 447.089	73 670.323	68 038.891
Manufacturing nec; recycling	4 490.456	12 787.519	18 424.901	24 347.602	23 511.697
Electricity, gas and water supply	13 594.06	15 310.027	18 148.353	25 784.994	15 096.375
Construction	6 961.255	3 678.456	4 193.375	7 568.848	7 790.441
Wholesale and retail trade; Hotels and restaurants	91 774.56	109 204.089	123 230.904	177 098.307	146 167.698
Transport and storage, post and telecommunication	74 441.167	90 148.657	108 762.719	141 289.922	123 780.879
Financial intermediation	33 093.882	53 435.225	75 044.549	101 817.386	108 971.015
Business services	92 598.494	162 980.981	216 787.697	321 402.503	302 719.072
Other services	11 073.124	22 317.04	26 139.802	35 330.47	33 421.234

NOTE: *http://stats.oecd.org on 02.02.2015 it was prepared with data*

Value added in gross exports by source country and source industry					
China					
	1995	2000	2005	2008	2009
TOTAL	141 474.655	268 465.832	804 375.282	1 525 635.623	1 283 964.189
Agriculture, hunting, forestry and fishing	14 575.506	20 770.531	54 311.544	102 214.952	82 802.486
Mining and quarrying	8 374.664	17 436.857	62 568.56	148 952.331	102 587.62
Food products, beverages and tobacco	4 043.279	6 602.844	13 706.604	27 501.469	22 911.775
Textiles, textile products, leather and footwear	19 190.214	31 809.238	49 324.579	97 401.967	88 461.876
Wood, paper, paper products, printing and publishing	3 039.211	6 320.653	21 570.079	40 193.226	34 848.747
Chemicals and non-metallic mineral products	18 085.268	33 925.617	92 839.226	167 179.826	136 130.17
Basic metals and fabricated metal products	9 772.02	16 552.313	66 559.902	120 050.682	93 312.588
Machinery and equipment, nec	5 027.271	6 048.248	35 075.636	64 821.067	51 960.276
Electrical and optical equipment	10 947.42	36 205.189	120 994.666	217 088.662	194 343.906
Transport equipment	2 155.627	4 361.285	17 918.359	33 187.594	27 356.761
Manufacturing nec; recycling	5 030.987	4 445.068	28 186.583	52 757.034	42 104.474
Electricity, gas and water supply	3 088.634	9 877.707	26 663.795	37 750.622	28 914.801
Construction	219.467	615.124,00	1 875.027	3 671.052	3 347.297
Wholesale and retail trade; Hotels and restaurants	12 412.702	31 718.831	73 751.143	149 921.349	132 559.307
Transport and storage, post and telecommunication	10 450.921	16 601.984	42 236.949	73 251.027	60 629.862
Financial intermediation	5 455.66	12 141.227	32 275.59	59 991.591	56 679.46
Business services	9 069.421	11 375.45	51 918.962	104 324.725	99 695.612
Other services	536.383	1 657.668	12 598.079	25 376.446	25 317.173

NOTE: *http://stats.oecd.org On 02.02.2015 it was prepared with data*

APPENDIX C: Comparison of Turkey with Germany, South Korea, China, and USA

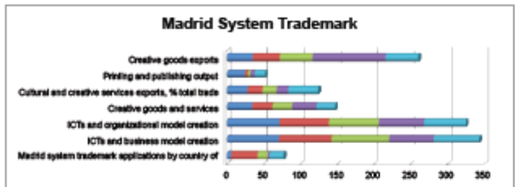
INDICATORS	USA	Germany	South Korea	China	Turkey
Innovation Input Sub-index	67,9	60,3	62,2	45,8	36,5
Institutions	86,2	82,7	75,8	48,3	54,9
Political environment	81,4	85,8	72,7	40,1	47,2
Political stability and absence of violence/terrorism	81,2	84,6	69,7	52,3	39,7
Government effectiveness	90,5	91,4	72,9	41	51,6
Rule of law	81,2	82,9	72,9	32,9	47,4
Business environment	84	81	87,8	55,5	62,7
Human capital and research	58,3	56,3	64,1	48,4	33,3
Education	52,6	53,4	54,4	71,3	41,7
Expenditure on education	38	35,2	35	0	17
Government expenditure on education per pupil, secondary	25,1	25,5	24,4	0	0
School life expectancy	76,8	75,2	80	53	62,2
Graduates in science and engineering	25,4	48	56,2	0	38,8
QS university ranking average score of top 3 universities	98,7	77,4	75,8	76,8	30,4
Research and development (R&D)	81,3	67,7	82,6	45	22,5
Information and communication technologies (ICTs)	83	74,3	91,3	30,1	32,3
ICT access	72,4	85,1	82,8	43,6	51,1
ICT use	67,6	60,5	82,2	27	26,3
Market sophistication	83,8	60,1	65,4	50,5	49,1
Microfinance institutions' gross loan portfolio	0	0	0	2,3	0
Investment	87,3	42,7	57,3	40,5	38,7
Venture capital deals	100	52,6	5,5	6,9	0,7
Trade and competition	85,6	80,8	71,2	75,1	84,2
Applied tariff rate, weighted mean	94,4	96,2	69,2	85,5	90,3
Market access for non-agricultural exports	87,5	64,9	52,4	72,8	86,8
Knowledge workers	73,6	62,8	61,2	59,4	34,4
Employment in knowledge-intensive services	63	75,8	36,8	11,7	34,5
Firms offering formal training	0	41,4	46,9	100	33,7
GERD performed by business enterprise (% of GDP)	58,8	58,9	93,2	45,5	11,2
GERD financed by business enterprise (% of GERD)	82,7	79,2	90,6	90,2	51,1
Innovation linkages	46,4	46,4	40,7	30,5	25,1
University/industry research collaboration	79	73,2	61,3	56,8	47,7
State of cluster development	70,5	73	57,7	60,2	57
Joint venture/strategic alliance deals	24,2	10,7	9,2	9	5,9
Patent families filed in at least three offices	70,6	84,3	98,4	24,7	6,1
Knowledge absorption	41,3	29,2	26,3	35,5	16,8
Royalties and license fees payments (% of total trade)	54,4	23,1	41,4	26,3	10,3
High-tech imports	69,4	37,8	50,9	81,2	31,8
Knowledge and technology outputs	56,1	53,1	54,5	59	32,3
Knowledge creation	68,5	65	74,8	67,1	30,2
National office resident patent applications	100	88,9	100	100	24,1
Patent Cooperation Treaty resident applications	44,1	60	66,1	28,4	12
National office resident utility model applications	0	49,2	43,4	23	30,4
Scientific and technical publications	30	42,9	43,4	23	30,4
Citable documents H index	100	100	44,1	51,2	27,2
Knowledge impact	56,7	48,4	44,3	65,7	40,5
New business density	0	8,5	5,6	0	5,2
Madrid system trademark applications by country of origin	5,9	36,5	13,5	3,1	19
ICTs and business model creation	71,3	72,2	78,3	60,7	60,5
ICTs and organizational model creation	72	67,8	68,2	61,5	55,5
Creative goods and services	34,4	27,6	27,2	33,6	24,9
Cultural and creative services exports, % total trade	28,3	20	19,5	15,9	41,2
Printing and publishing output	25	3,6	3,2	6,4	14,3
Creative goods exports	35,2	37,3	44,4	100	44,6

APPENDIX D: Turkey's Global Innovation Index Based on Comparison Data by Years

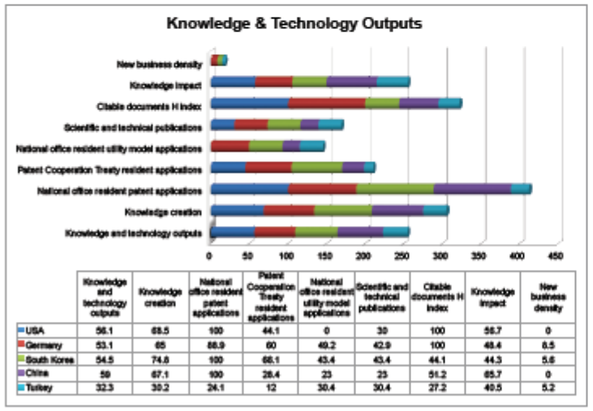
INDICATORS	2011	2012	2013	2014
Innovation Input Sub-index	34,1	30,7	38	36,5
Institutions	62,1	50	55,8	54,9
Political environment	43,5	45,8	48,8	47,2
Political stability and absence of violence/terrorism	82,1	47,7	63,4	39,7
Government effectiveness	18,1	41,2	43,4	51,6
Rule of law	63,8	50,2	49,6	47,4
Business environment	58	50,5	49,3	62,7
Human capital and research	32,9	31,8	29,8	33,3
Education	49,9	41,2	40,8	41,7
Expenditure on education	37,6	2,6	2,6	17
Government expenditure on education per pupil, secondary	18,6	12,2	12,2	0
School life expectancy	45,8	12,9	13,8	62,2
Graduates in science and engineering	31,4	20,9	20,3	38,8
QS university ranking average score of top 3 universities	20,9	23,3	19,5	30,4
Research and development (R&D)	43,3	38,5	26,7	22,5
Information and communication technologies (ICTs)	30,1	31,5	30,9	32,3
ICT access	46,6	49,7	51,2	51,1
ICT use	15,8	24,6	20,9	26,3
Market sophistication	38	39,4	47,5	49,1
Microfinance institutions' gross loan portfolio	12	0	0	0
Investment	32,5	36,5	31,9	38,7
Venture capital deals	40,2	7,6	0	0,7
Trade and competition	52	64,5	84,4	84,2
Applied tariff rate, weighted mean	91,2	2,4	2,4	90,3
Market access for non-agricultural exports	77,9	1,4	1,1	86,8
Knowledge workers	41,1	47	40,4	34,4
Employment in knowledge-intensive services	40,6	22,1	17,6	34,5
Firms offering formal training	30	28,8	28,8	33,7
GERD performed by business enterprise (% of GDP)	48,6	40	0,4	11,2
GERD financed by business enterprise (% of GERD)	57	41	45,1	51,1
Innovation linkages	21,8	22,9	18,8	25,1
University/industry research collaboration	39,5	41,5	42,8	47,7
State of cluster development	41	40,1	49,2	57
Joint venture/strategic alliance deals	4,9	24,6	0	5,9
Patent families filed in at least three offices	3,5	4,5	0	6,1
Knowledge absorption	25,1	27,5	17,9	16,8
Royalties and license fees payments (% of total trade)	11,7	1,1	3,2	10,3
High-tech imports	23,6	9,9	8	31,8
Knowledge and technology outputs	18,9	27,8	30,4	32,3
Knowledge creation	17,9	31,6	22,6	30,2
National office resident patent applications	16,8	0,3	4	24,1
Patent Cooperation Treaty resident applications	6,7	0,5	0,4	12
National office resident utility model applications	24,7	3,2	3	30,4
Scientific and technical publications	26,7	9,4	20,9	30,4
Citable documents H index	N/A	N/A	193	27,2
Knowledge impact	17,7	30,1	45,7	40,5
New business density	6,7	0,9	1	5,2
Madrid system trademark applications by country of origin	36,2	0,8	0,8	19
ICTs and business model creation	63	52,9	59,5	60,5
ICTs and organizational model creation	53,1	46,1	53,9	55,5
Creative goods and services	32,5	30,8	40,5	24,9
Cultural and creative services exports, % total trade	33,9	4,1	N/A	41,2
Printing and publishing output	44,3	4,6	1,6	14,3
Creative goods exports	33,5	5,3	3,7	44,6

NOTE: *193 documents containing the table for entering the index "0" was considered.*

Innovation Output Sub-Index



	Madrid system trademark applications by country of origin	ICTs and business model creation	ICTs and organizational model creation	Creative goods and services	Cultural and creative services exports, % total trade	Printing and publishing output	Creative goods exports
USA	5.9	71.3	72	34.4	28.3	25	35.2
Germany	36.5	72.2	67.8	27.6	20	3.6	37.3
South Korea	13.5	78.3	68.2	27.2	19.5	3.2	44.4
China	3.1	60.7	61.5	33.6	15.9	6.4	100
Turkey	19	60.5	55.5	24.9	41.2	14.3	44.6

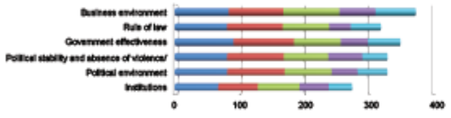


	Knowledge and technology outputs	Knowledge creation	National office resident patent applications	Patent Cooperation Treaty resident applications	National office resident utility model applications	Scientific and technical publications	Citable documents H Index	Knowledge impact	New business density
USA	56.1	68.5	100	44.1	0	30	100	56.7	0
Germany	53.1	65	88.9	60	49.2	42.9	100	48.4	0.5
South Korea	54.5	74.8	100	66.1	43.4	43.4	44.1	44.3	5.6
China	59	67.1	100	28.4	23	23	51.2	65.7	0
Turkey	32.3	39.2	24.1	12	30.4	30.4	27.2	40.5	5.2

Comparative Global Innovation Index Map

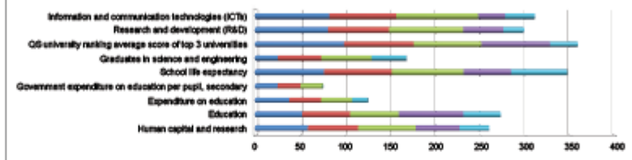
Innovation Input Sub-Index

Institutions



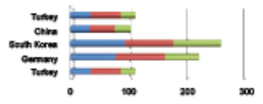
	Institutions	Political environment	Political stability and absence of violence/ terrorism	Government effectiveness	Rule of law	Business environment
USA	87.9	81.4	81.2	90.5	81.2	84
Germany	80.3	85.8	84.6	91.4	82.9	81
South Korea	62.2	72.7	69.7	72.9	72.9	67.8
China	45.8	40.1	52.3	41	32.9	55.5
Turkey	36.5	47.2	39.7	51.6	47.4	62.7

Human Capital and Research



	Human capital and research	Education	Expenditure on education	Government expenditure on education per pupil, secondary	School life expectancy	Graduates in science and engineering	QS university ranking average score of top 3 universities	Research and development (R&D)	Information and communication technologies (ICTs)
USA	58.3	52.6	38	25.1	78.8	25.4	98.7	81.3	83
Germany	56.3	53.4	35.2	25.5	75.2	48	77.4	67.7	74.3
South Korea	64.1	54.4	35	24.4	80	56.2	75.8	82.6	91.3
China	48.4	71.3	0	0	53	0	76.8	45	30.1
Turkey	33.3	41.7	17	0	62.2	38.8	30.4	22.5	32.3

Information & Communication Technology

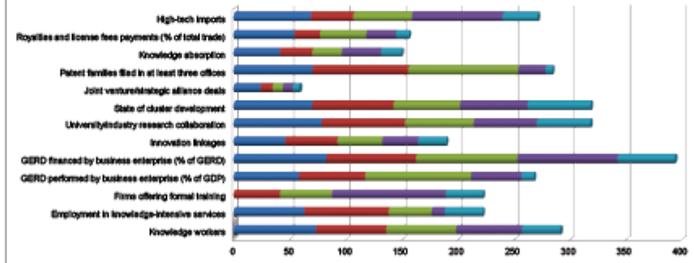


	Turkey	Germany	South Korea	China	Turkey
Information and communication technologies (ICTs)	32.3	74.3	91.3	30.1	32.3
ICT access	51.1	85.1	82.8	43.6	51.1
ICT use	26.3	60.5	82.2	27	26.3

Market Sophistication

	Market sophistication	Microfinance institutions' gross loan portfolio	Investment	Venture capital deals	Trade and competition	Applied tariff rate, weighted mean	Market access for non-agricultural exports
USA	83.8	0	87.3	100	85.6	94.4	87.5
Germany	69.1	0	42.7	52.6	80.8	96.2	64.9
South Korea	65.4	0	57.3	5.5	71.2	69.2	52.4
China	50.5	2.3	40.5	6.9	75.1	85.5	72.8
Turkey	49.1	0	38.7	0.7	84.2	90.3	66.8

Knowledge Workers



	Knowledge workers	Employment in knowledge-intensive services	Firms offering formal training	GERD performed by business enterprise (% of GDP)	GERD financed by business enterprise (% of GERD)	Innovation linkages	University/ industry research collaboration	State of cluster development	Joint venture/ strategic alliance deals	Patent families filed in at least three offices	Knowledge absorption	Royalties and license fees payments (% of total trade)	High-tech imports
USA	73.6	63	0	58.8	62.7	48.4	79	70.5	24.2	70.6	41.3	54.4	69.4
Germany	62.8	75.8	41.4	58.9	79.2	48.4	73.2	73	10.7	84.3	29.2	23.1	37.8
South Korea	61.2	36.8	46.9	93.2	90.8	40.7	61.3	57.7	9.2	98.4	26.3	41.4	50.9
China	59.4	11.7	100	45.5	90.2	30.5	56.8	69.2	9	24.7	35.5	26.3	81.2
Turkey	34.4	34.5	33.7	11.2	51.1	25.1	47.7	57	5.9	6.1	16.8	10.3	31.8