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University – Industry – State R&D Cooperation and Tech-parks

ABSTRACT
Currently technology and science are developing at an unforeseen rate. In our world which has become a small village, cooperation between of University, Industry and State is the only possible way for industries and states to be independent and strong. In order for the relevant cooperation to be effective, different disciplines and human resources should be successfully managed. The State has to use its directive power and make means and conditions available.
In the present study, cooperation of university, industry and state has been researched, and its global examples have been assessed. The relevant necessary factors are explained and suggestions are made.
Key words: *University-industry-state cooperation, R&D, Tech-park.*

Introduction

In the 21st century both interior and exterior environmental factors are changing at a dazzling speed. Cooperation of universities, states and industry allows the industry and the state to stand on its own feet. It is clear that the nations that have progressed in science and technology for to become world powers have already created this cooperation. Progress in spheres of science and technology has pushed the states into creating laws and incentives towards universities and industry. United States of America and Israel are the best implementers of these policies.

Turkish Republic has created policies in order to create such cooperation. The first Five Year Development Plan (1963-1967) is the first document that takes the university and industry cooperation into consideration. The Turkish Industry Strategy Document that was published in December 2010 is a work done in this sphere. Stimulation of science and technology is done with cooperation among universities, industry and the state. Universities are producing knowledge. Industry adds value and creates richness. The state ensures cooperation between universities and industry (Yalçıntaş, 2014:84-85).

In the current century the created products must be of good quality; they must be provided to the market with convenient pricing in order to be able to compete in the globalized world. Industries and states that have put great emphasis on scientific research have gained the upper hand and they became leaders. Progresses in scientific and technological spheres take time. Therefore, industries and states must think on long term and envisage future.

Technological competition is provided by human workforce equipped with scientific knowledge. Industries gain the power to compete when a healthy university and industry cooperation is created within the frame of advanced technology. Research labs, techno parks and industrial parks support the technological advancement. Many universities in the west create new methods and strategies in order to create cooperation with industry and they do research to develop profitable and technologically superior products. Universities also work on increasing economic prosperity along with education and research. Therefore, universities generate industries equipped with advanced technologies (Kaykayoğlu, C. R).

Developed and developing countries place a great emphasis on the university and industry cooperation and they provide great incentives. Japan, who had no scientific and technological power in the era of the Second World War, has created an interaction between education and production and they became an important power. Germany also was successful in creation this system and they became a powerful state as regards to advanced technology (Göker, 2000:2-3).

Knowledge providing economic benefits is possible only through many complex connections between universities, industry and the state (Koç and Mente). Enabling all necessary factors and working them in harmony and gaining permanency are responsibilities of the state.

State, University and Industry Co-Operation

Transition from agrarian society, basing on human workforce, into industrialized society changed the rules of economical competition completely. On the wave of the Industrial revolution science, which turned into prominence and brain power, came into use. The greatest factor in classifying countries as non-developed or developed is the fact that the developed countries create and produce new products with the ease provided by science. The most prominent feature regarding non-developed countries is that they are lacking in the sphere of science and technology and their use of human resources is inadequate.

Agenor, Canuta and Jelenic stated that developed countries have public arrangements supporting technology, education, research and development (R&D). There is a direct positive correlation between economical advancement of countries and the number of patents that they hold.

Changes are successful when technology is authentically created, not imported. Countries that developed authentic technology can create products with more value added, which increases their economical growth.

Knowledge created by universities cannot be used on one-to-one basis in industry. Therefore most of industrial establishments do not have the means for technological advance of their products. These problems can be settled through cooperation. It is obvious, that the less developed countries cannot develop technologies and they are purchasing them. The countries that command technology do not share their knowledge and they

are in a constant search for new markets. In this context it is clear that the countries that are purchasing technology cannot possibly develop their own. These factors, along with the stagnated technological progress, equals to dependency that has gained perpetuity. Therefore, the countries that possess advanced technology coupled with a continuous progress are also the ones that have economic prosperity (Yalçıntaş, 2014:86-87).

The countries that cannot establish cooperation between the state, universities and industry are forced to close down or to sell their production facilities since their industries cannot develop new products. These states constantly purchase their technological products or production machines (Göker, 2000). These developments do not enhance the prosperity rates and they also create a perpetual dependency.

80% of today's scientific researches are readily available. Articles, databases and contractual data centers have made accessing scientific publications straightforward. Despite this, access to many important findings and articles is commercial and limited. These factors restrict access to scientific studies.

Industries must keep a close watch on scientific research and they must establish a permanent flow of information through creating various contacts. The information that reaches the company shouldn't be stuck at the office of admissions. They should reach the staff that shapes the information strategies and policies. Senior executive staff of industries must have a clear and healthy communication with the universities. But this communication must never be one sided. Universities, as well, should have access to any information they need. Universities must educate their students within the framework of the curriculum provided by the Yüksek Öğretim Kurumu (YÖK) with the goal of advancing the national agenda. Universities must have their high executives of national or international in international enterprises providing special education for the students to create cooperation with the industry. Adjustments to the class contents must be made to ensure that YÖK students are more successful while working in companies. Education faculties must be equipped with the best available technological devices to develop the industry with qualified graduates. All these must be ensured by cooperation among the state, universities and industry.

The countries that have a goal of accelerating technological progress place a great emphasis on cooperation among the state, university and industry. Techno parks built in university campuses in Turkey (Akdeniz, Middle East Technical University, İstanbul Technical University, Yıldız Technical University, Karadeniz Technical University) are great examples of industry and university cooperation. The reason for Scotland's advanced technological innovations along with a great quality of education is the fact that they built techno parks near their education facilities. This cooperation gives both physical means and scientific power, creates efficiency in use of resources and allows the scientific power to be commercialized (Aydınol, 2012:769-773).

The countries that allow science and technology to be used in industry increase their levels of economic prosperity at a great speed. Regulations that create supply of educated workforce, that decrease amount of bureaucracy involved and allow the necessary flow of finances must be made by the state. Foreign investments that create gains in technology and commercial and technological policies must also be kept in mind. New regulations must be made in this regard. Continuity in the progress of science and technology forces industry and individuals to have continuity in progress as well.

The conversion and transformation of all factors and existing technologies should be made permanent through learning and internalizing new technologies in relationships among university, industry and state. In this process, knowledge provides added value. While the university is producing knowledge, industry must transform it into a usable form. The state must resolve the knowledge and financial deficiencies of industries that fall short on R&D. Freeman (1995) defines the R&D activities of universities and public research labs as the source of cooperation between university and industry.

Industry must provide a stable flow of knowledge and collaboration using their practice, experience and educated workforce supplied by the university. All sides must join together to create a coalition of science, technology, experience and financial strength. The state must put the judiciary and the structural processes in a working order. Economical and technological advancements, R&D, technology transfers, development plans and education are factors of cooperation between the university and the industry (Koç and Mente).

a–States

All States on Earth have started joining the cooperation between university and industry in the 21st century. Scientific and technological progress as well as economic development depends on many sides working in full cooperation and harmony. It is hypothesized that the state can provide this cooperation in a more efficient manner and can provide ways to make it perpetual. The state ensures that the resources and facilities are used more effectively and efficiently by universities and industry. Therefore, it is predicted that because of this cooperation technological facilities that reach very high costs to build will be saving resources (Çetin, 2009:65-66).

Cooperation with industry must be created by employing a qualified workforce in the state institutions. Rapid developments in science and technological spheres require the states also rapidly increasing the speed of their work on cooperating with the universities. In this regard, the states must place an emphasis on training a qualified workforce that fits in with the changing conditions of industry and the present market. The states make financial aids and create legal and judicial regulations to incentivize scientific researches (Kaykayoğlu, C. R). A qualified workforce will lead many developments that will abolish the bureaucracy.

b–Unıversıtıes

Cooperation between any university and industry must be made permanent by incentives given by the state. The universities must have software and hardware labs that the industry needs. The post graduate and the doctoral theses that are being written should be beneficial to the growth of industry. In this regard, the universities must ensure development of industry by creating a constant flow of information. Universities must perpetually develop industry using the workforce that is trained with the knowledge of advanced technology (Kaykayoğlu, C. R). Cooperation created between university and industry must not be left as it is after its establishment, the flow of information should be made perpetual.

Development of research projects, acquiring resources for projects, access to knowledge, students being familiar with industry, holding patents and scientific publications are all factors in reinforcing the cooperation between university and industry. Therefore, universities are interested in producing knowledge and knowledgeable workforce, in supports made for R&D projects and in having workforce that has graduated finding employment in industry (Çetin, 2009:59-60).

Students, along with theoretical knowledge received in the university, must be familiarized with industry and they must receive results of their work as soon as possible. The processes that allow all sides to communicate as fast as possible have gained a great importance. High tech centers such as techno parks being built on university grounds or near them, allow universities to gain ideas on the field of advanced technology. These developments increase the economic prosperity of university, industry and the area that they are established on.

Germany has its academic members constantly updating their universities on their work and they have imposed that the universities owning the copyrights to their ideas. It is stated that the reason behind this attempt is the fact known as "Knowledge creates market" (Kiper, 2010).

c–Industry

Industries first and foremost expect a safe, stable market without any fluctuations to be established by the state. Industries do not desire to invest in economically unstable economies. States encourage development by purchasing from local industries. While industries become technological leaders using the cooperation established with the universities, corporations become brands. Cooperation allows industries and universities to get to know one another and, therefore, decreases the adaptation and education times in the corporations (Çetin, 2009:62-63).

Industries that was established in adherence to science and technology while employing a workforce that was brought up with scientific knowledge gains the power to compete by producing products that has a high added value. Industry must always be changing and transforming in accordance with the changes that technology brought. Industry must ensure that science created by its R&D is transformed into factors of production. For to achieve all of this, industry must ensure that there is a stable flow of information between universities, academicians, labs and the market, which allows cooperation of all of them. Technologically advanced countries of our day make sure that there are no technology transfers. Industries must make long termed predictions that target the international markets (Kaykayoğlu, C. R). Industries cannot remain sustained with short term policies. Industries must make their investments and R&D activities within the perspective of long term advantages.

Knowledge and Economy

Desire and need for people's prosperity are advancing knowledge. In 21st century the power to compete is increasing along with capabilities and knowledge of human resources. Knowledge is the most important factor in increasing economic prosperity. Economical development depends on actors working in tandem despite their differences. Integration of actors within the perspective of the objective must be made. Continuity of change and progress is a must.

All actors in the sphere of economy, politics and education must be brought together in the platform supported by knowledge. The R&D activities made by industries are insufficient. Therefore, success and economical prosperity depend on continuity of cooperation and sharing of information. Information sharing must never be stopped; the communication with the market must also be continuous. Supplier and user cooperation must be abolished in this regard. In these situations cooperation never works.

When cooperation becomes a culture in industries and universities and is wholly internalized, it finally gains continuity. Industries must follow developments in technological systems closely. Those establishments that cannot adapt to changes simply perish. Nowadays, cooperation and information sharing between establishments that have different cultures has gained a great importance. The state must build labs, grant financial aids to universities and must incentivize private or public research activities. Judicial regulations must be set up in such spheres as technological standards and intellectual property (Koç and Mente).

Research and Development (R&D)

Despite their R&D activities, industrial establishments cannot be truly successful. Industries must be in cooperation with universities and other science institutions and they must have a continual flow of information. Development of new products within the framework of objectives and goals will be ensured when this cooperation and information flow is established. This will in turn allow development of high added value products. Industries must have access to science and technology while continuously striving to improve them in order to ensure their continuity of existence. Industries must establish a full cooperation with R&D, application centers and other institutions within their sector, while creating a perpetual flow of information (Aydınol, 2012:767).

For to create new technologies, R&D labs, patent industries, scientific and technological data centers, science parks, universities and libraries must all be in full cooperation with the public institutions that regulate scientific and technological policies. The state must support education and research. The state must also build an infrastructure that is flexible and proper enough for cooperation with industries and financing R&D activities. All sides must act in concert in this matter. Society's social and cultural norms, level of knowledge, current judicial circumstances, state administration, economic and social elements are all factors that affect success of this cooperation.

The research done on the subject of R&D and cooperation in the USA, Europe and Japan, showed that development and progress of the production factors originate from interaction between workforce, market, R&D and the establishments that are involved. Countries that were unable to establish cooperation between the state and industry despite their scientific and technological advancements while viewing raw production numbers supreme and also failing to establish a technological common ground with the rest of the world, such as the Soviet Socialist Republics, have lost their scientific and technological edge. The countries that have established a continuous cooperation between scientific factors and production factors, such as Japan, Israel, China and South Korea, have gained technological superiority in the 21st century (Koç ve Mente).

Techno-Parks

Techno parks exist for to increase economic prosperity for establishments that works basing on knowledge by increasing their competency in the matters of change and competition. Universities also create a flow of information flow with industry and the market. They must ensure that high added value products are produced.

Collaborated projects between universities and techno parks, scientific knowledge converting into commercial activity, number of patents taken, industry consulting the universities, university researches transitioning into industry are all indicators of the success of techno parks. The cooperation must not be limited to techno parks. Universities and techno parks should make collaborated research projects and these projects must receive stimulating support. Nationwide advanced technology research programs constitute the Japanese industrial strategy. All Japanese cities have a research program in the application. Therefore, the universities are founded within the framework of the cities, and the whole country became a techno state. The state, along with construction of airports in these cities, supports foundation of science cities that have cooperation between public institutions and universities (Kiper, 2010:46).

United States of America is the number one in the list of the countries with the most patents taken. In 2014, Japan has made 42459 patents, and China has made 25539 patent applications. More than 60% percent of global patent applications are made by the USA, Japan and China. Turkey has made 802 patent applications in 2014 (http://amerikabulteni.com/2015). The indicated number clearly shows a lack of work done in this regard in Turkey.

Researches made in England show that establishments having activities in techno parks make more product and patent applications. The Silicon Valley in the USA is the place where the idea of techno parks was created. The USA, China and Germany are the countries which export the most manufactured goods. North Carolina, which used to be one of the poorest states of the USA, had an economy based on agriculture. It became a leader in R&D activities after foundation of three universities. After this, North Carolina became one of the richest states in the USA (Yalçıntaş, 2014:91-102).

Techno-park İstanbul, a techno park that is being built on 2.5 million square meters of land, is adjacent to the Sabiha Gökçen Airport. When it is completed, it will have 950.000 square meters of indoor area, making it one of the largest techno parks in Europe and the largest in Turkey. With 30.000 high quality employees, it is predicted to have a turnover of 10 billion dollars (www.teknoparkistanbul.com).

Conclusion

For to acquire science and technology with the help of the state, universities and industries, the current technology must be continuously progressing and this technology must be converted into the means of production. Economic prosperity occurs when knowledge produced in universities is transformed into new, marketable products in industries. If production is not taken into consideration, the knowledge produced in universities does not increase economic prosperity.

Competency in science and technology must be gained with long term strategic plans. Economic prosperity, development and quality of life all depend on technological competency. This outlook must be internalized by individuals in the society as a culture.

A network of rapid access to knowledge must be created. The establishments that provide such as industrial clusters or techno parks must be supported. When cooperation of the state, universities and industries are considered as a whole, great national benefits will be made.

The State must support scientific projects with laws and incentives. Large establishments and many universities created fund resources devoted to scientific research and they have built techno parks. The state supporting such cooperation financially will create a workforce trained with technological knowledge and this, in turn, will be the beginning of economic prosperity. This process takes a very long time and it is inherently fragile. Therefore, all sides must take care of this process and its continuity.

The established cooperation must be placed in a framework of a win-win situation to have all sides working for the continuity of cooperation with their consent. In this context universities must receive support to gain necessary competency in order to create a desire for their cooperation with industry. Many countries do works in this regard and they create strategies depending on their cultural and structural make up. The European Union does research with the goal of transforming research results into economic factors.

States must remove all factors and laws standing on the way of cooperation between universities and industries, and they must financially and otherwise promote such cooperation. Science and production collaboration is possible only with the source of science and knowledgeable workforce. It should be remembered that universities have responsibility to education and long term researches, and they must be supported in these activities.

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