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ECONOMIC DEVELOPMENT-INDUSTRALIZATION AND RESEARCH&DEVELOPMENT IN WORLD ECONOMY*

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ABSTRACT: *Industrialization is a fundamental goal for a significant portion of developing economies. However, these countries only began the industrialization process that England began in the 1600s in the mid-1900s. In the industrialization stages defined as Industry 1.0, Industry 2.0, Industry 3.0 and Industry 4.0, most developing countries are currently somewhere between Industry 2.0 and Industry 3.0. Most developed economies are currently in the Industry 4.0 industrialization stage. From this point of view, it is seen that the difference between developing and developed economies is high. Although there are many reasons for this difference, it should be noted that the essence of the difference between the two groups of countries is related to the importance they give to education and research and development. In this study, the importance of R&D in the economic development-industrialization relationship and the details of the industrial structure of the world economy today will be examined.*

KEYWORDS: *Economic Development, Industralization, R&D activities, German Historical School, Education*

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1 Introduction

No country in the world exists alone. Therefore, countries interact with each other and each country determines its relations with other countries depending on its level of economic development. And the level of economic development of each country determines the trade and other relations of other countries. Therefore, it can be said that the

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phenomenon of economic development is not only related to the country in question, but also a phenomenon and process with an international dimension. This situation is valid not only in the global economy conditions but also in the conditions of the 20th century.

The phenomenon of economic development was mainly related to industrialization after the industrial revolution that emerged in the 16th century. After the industrial revolution that took place in Britain, industrialization became the desired goal for other countries as well. The 1900s were a period in which the importance of industry over agriculture was emphasized in economic literature. The most well-known theoretical postulate of this is the Singer-Prebisch thesis. The 2000s, on the other hand, represent a period in which technological products were more valuable than traditional industrial products in industrialization. Today's world economy conditions are global economy conditions and the global economy includes global competition. Therefore, it is of great importance for countries to compete in the global economy.

2 Economic Development and Industrialization

Economic growth and economic development are different concepts. Economic growth is a sub-element within economic development. In determining economic growth, the national income level in a country and the general change of this level from year to year are important. However, in determining economic development, the phenomenon of economic growth -although it can be an important criterion - is not a sufficient criterion on its own. Therefore, in order to classify economies among countries in terms of economic development, it is necessary to take into account not only the concept of economic growth, which expresses the national income level and its change from year to year, but also some other basic indicators. In classifying economic development among countries, the composition of production sectors within national income and the position of the industrial sector within this composition are of great importance. The importance of this

element is valid not only in the 20th century, when industrialization was of relative importance, but also today.

In classifying the development difference between economies (which has great importance in affecting production), human living conditions must be another criterion. For example, in countries with a weak economic development level, the consumption of basic consumer goods has a higher weight in total consumption expenditures. In a society with an underdeveloped economy, per capita national income is low. In this case, it is expected that income distribution will be very bad. In these conditions, the people are faced with malnutrition and poor housing conditions. These negative conditions will obviously negatively affect the production level in the economy. In such economies, socio-economic living conditions largely express low standards, while on the other hand, health problems are an important issue under the influence of this low standard of living. And again, in these countries with a low economic development level, there is also a great deal of inequality of opportunity in education. The factors that are effective in classifying economic development among countries can be further increased.

It should be noted here that when economic development is discussed in a broad sense, it is necessary to focus not only on a mechanical process such as the increase/growth of production (input-output analysis); but also on the quantitative and qualitative developments in the form of leaps in the labor, natural resources, capital stock, technological knowledge level and the socio-economic structure in which the economy operates, which constitute the production function. In this context, it can be said that the development of the human factor as a production factor is of great importance in order to achieve economic development. The development of the human factor, also called human capital, is important not only for the acceleration of general economic development, but also for industrialization, which has a special place in terms of the production and use of information (and is also linked to economic development). Therefore, when talking about production factors in the economic development process, it is a

necessity to emphasize the human factor, which is the subject of these factors, and its development [1]. The human factor describes human capital and constitutes the main element of Research and Development activity.

3 R&D Activity in the Relationship Between Economic Development-Industrialization And Competitiveness

The world economy entered a new structure called the global economy in the 1990s [2]. While the countries of the world lived in a relatively inward-looking economic structure until the 1970s, they started to open their economies to each other more after the 1970s. This opening up, which first manifested itself in the form of more trade, paved the way for the world economy to become a global economy over time, and the world economy became a global economy by the 1990s. There are many determinants in the world economy becoming a global economy. Among these, multinational corporations are of great importance. Because while multinational corporate entrepreneurship sees the world as a market and a source of raw materials, they have been the greatest supporters of overcoming national economic borders. Apart from multinational corporate entrepreneurship, the development effect of technological development on the world economy, liberalization and the increase in the efficiency of financial capital, the liberalization of legal systems and the increase in the efficiency of international institutions and the collapse of the USSR should also be added as a factor [3].

While the world economy has become a global economy, protectionism between countries has been reduced (customs walls have been lowered) and therefore international trade has become easier compared to previous periods. At this point, it is necessary to think and take into account the Uruguay Round and later the World Trade Organization. While trade between economies has increased, competition in international markets has also increased. Increasing competition has pushed companies to new searches in order to exist and compete in the markets.

The concept of competition essentially describes the struggle of more than one element to get ahead. While companies, institutions and individuals struggle with competition, it is an activity that includes the problem of living and existing, but also has the opportunity to develop the competing elements. In today's global world, new technologies develop in a short time and products become obsolete rapidly and there is high-level competition in the markets [4].

Today's global competitive environment has brought more effort for companies and at this point, companies have started to aim to reduce costs with new production techniques and to obtain new products and present them to the markets first. Developing new production techniques and new products essentially involves research and development (R&D) activities. In other words, companies' ability to develop new products and production techniques necessitates them to allocate resources to R&D. When viewed from this perspective, companies' ability to compete in global economic conditions depends on focusing on research and development beyond classical cost advantages and developing new technologies. Of course, R&D activities and technological development in production were important before global economic conditions, but they have changed significantly depending on countries' relative inward-looking economic conditions and global economic conditions in the world economy [5]. In this context, there is a need to examine R&D activity, which has an important place in competitiveness in the global economy.

Research and development activities in an economy are systematic and creative studies carried out to develop and produce new products and/or to develop and improve production processes[6]. Development activity is the activity of making an existing element or structure more functional, effective and sophisticated. At this point, Research&Development activity can be defined as the activity of increasing the information about an element and making that element more functional, effective and sophisticated. According to OECD, "Research and experimental development (R&D) comprise creative and systematic work undertaken in order to increase the stock of

knowledge – including knowledge of humankind, culture and society – and to devise new applications of available knowledge" [7].

With the R&D activity, the development of production techniques and products in production in economies is in question. In this surround, it can say that R&D activity, supporting to technology is main factor of innovations. The value of innovation can be determined by how it changes the environment[8]. Innovation is shows itself in 4 forms: product innovation, process innovation, organizational innovation and marketing method innovation[9]. Developing technologies that provide innovation opportunities is also possible with R&D activities, if there are no coincidental discoveries. According to Gutterman "Research and development activities, commonly referred to as "R&D", are an essential part of any company's efforts to enhance its knowledge base and ultimately create, acquire, and integrate innovation into its products and processes. R&D is an inherently creative process generally engaged in by skilled and trained professionals from a widerange of scientific and engineering disciplines" [10].

The main purpose of R&D activity in an economy is to support the growth and adaptation of businesses and institutions operating in a constantly changing environment to the changes in the markets. Apart from this main purpose, some other purposes of R&D activity can be listed as follows [11]:

-"To develop new products and processes in production and marketing processes and to find new areas of use

-To find new production techniques in production or to improve existing production techniques

-To maintain competitive power in the markets

-To reduce costs in the business and increase efficiency".

According to OECD a R&D activity must be novel, creative, uncertain, systematic, transferable and/or reproducible[12]. According to U.S. Business Enterprise R&D, the following activities typically would be considered research and development within the scope of this topic[13].

i)“Laboratory research aimed at discovery of new knowledge

ii)Searching for applications of new research findings or other knowledge

iii)Conceptual formulation and design of possible product or process alternatives

iv)Testing in search for or evaluation of product or process alternatives

v)Modification of the formulation or design of a product or process

vi)Design, construction, and testing of preproduction prototypes and models

vii)Design of tools, jigs, molds, and dies involving new technology

viii)Design, construction, and operation of a pilot plant that is not of a scale economically feasible to the entity for commercial production

ix)Engineering activity required to advance the design of a product to the point that it meets specific functional and economic requirements and is ready for manufacture

x)Design and development of tools used to facilitate research and development or components of a product or process that are undergoing research and development activities”.

In a sense, internal technological advances can be experienced in the relevant economy together with R&D activities. In economies, innovations can be realized in production when technological development can be achieved. Innovations encourage production in the economy and support the improvement of production processes and products. The phenomenon of technology and technological change, which has become almost a fundamental factor in production in today's world, has been kept as an external factor in neoclassical growth models for a very long time [14]. But this perspective in neoclassical economists has been criticized by economists such as Nicolas Kaldor, Paul Romer, R. Barro, K. J. Arrow and others. These economists have seen technology as an internal factor in production. While technology

is seen as an internal factor in these economists, it has also been brought to a central role in their economic growth models [15].

At this point, it can be said that the Neo-classical growth model, in which productivity growth and technology are considered external phenomena, was changed in the 1980s. According to new growth theories that advocate long-term growth, R&D expenditures are considered as a factor that encourages developments in science and technology. R&D investments in technology and science fields are important criteria for evaluating economic development and competitiveness for an economy [16].

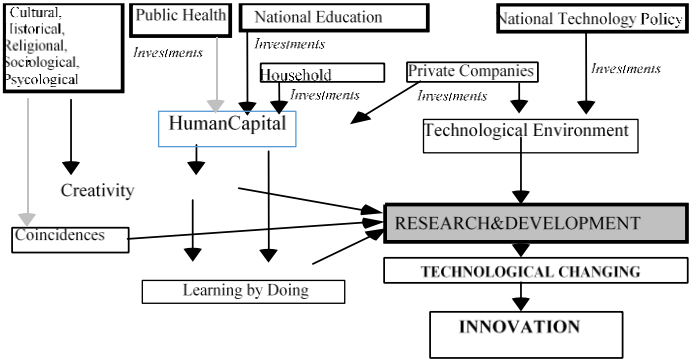

Figure 1: The Determinants of Research&Development and Innovation, Source: Kibritçioğlu; 1998,:217 (Schema 5.1).

The most fundamental criticism of neoclassical growth models on the subject of technology has been that they explain factor productivity through technological change and treat this situation as an "exogenous" variable. As Ö. Ülger's stated, economists such as Arrow, Kaldor and Conlisk have included the rate of technological change as an endogenous variable in the neoclassical growth model, and indicators such as R&D expenditures, human capital, and advanced technology imports have been included in the neoclassical growth model as an endogenous variable as an element of technological

change. Technology has become more important for economies especially in the 1990s and after. So much so that the effects of technology are no longer only seen in the production dimension, but in every area of life, including social life. In fact, the years when technology began to make its weight felt in production were the 1970s and 1980s. In a sense, technology began to make its weight felt clearly in economic life in these years. While technology made its weight felt in production in these years, economists also began to draw attention to the importance of technology in production. For example, in 1986 and 1988, Romer and Lucas and later (in 1990 and 2009) Philippe Aghion and Peter Howitt created growth models that emphasized technology[17]. P.Aghion and P. Howitt used to technology as key factor in their model [18].

It can be said that there are many factors that determine the Research & Development activity in an economy. Among these, it should be noted that (as can be seen in Figure 1) the cultural, historical, religious, sociological and social psychological factors of the countries are at the forefront. This set of factors supports creativity in the relevant society. Apart from this set, another factor that greatly affects human capital is Public Health and National Education Policy. All these factors determine the Technological Environment in an economy. The technological environment forms the background of the Research and Development activity. Research and Development activity in economies will determine the technological change in the relevant economy, which will manifest itself as innovation in the economy [19].

According to OECD R&D clasification there are 3 types R&D activity [20]:

i)Basic research–activities aimed at acquiring new knowledge or understanding without specific immediate commercial applications or uses.

ii)Applied research–activities aimed at solving a specific problem or meeting a specific commercial objective.

iii)Experimental development–systematic work, drawing on research and practical experience and resulting in additional

knowledge, which is directed to producing new products or processes or to improving existing products or processes".

In the world economy of the 21st century, the level of global competition is measured by technology transfer. According to this criterion, the country that produces and sells technology is the powerful country that possesses the technology and information resources. The world ranking in technology exports continues unchanged as the USA, Japan and the E.U. [21].

The importance of technology in economic life and the fact that it creates differences between countries has also been experienced in history between Britain and Germany, and the competition between these two economies should be an example for developing economies. In Britain, there were significant developments in industry after the industrial revolution. Towards the mid-1800s, the share of the industrial sector in the British national income reached 40 percent. In the process of transforming the principalities into national states, Germany was starting to implement a strategy that prioritized industrialization with the "Zolverein (National Custom Unity Approach)" policy within the national state approach, also known as the Historical School. With this strategy that it implemented in the mid-1800s, Germany drew closer to Britain. The German historical school and therefore F. List's formulation of industrialization have great importance in this success of Germany.

As A. Göker's stated, F. List believed that in order to learn the newly imported technology and apply it to economic life and develop new technology, this can be achieved primarily through the establishment of a national research and development network that includes the education-training system as a whole and industry, state machinery and universities. Germany's success has also shown that this approach is correct. While Friedrich List proposed this policy to ensure economic development and industrialization, he was largely inspired by the policy put forward by the famous American Treasury Secretary Alexander Hamilton (1755-1804) for the US economy. In the US, A. Hamilton argued in his Report on Manufactures (Hamilton, A., 1791)

presented to the House of Representatives on December 5, 1791, that in order for countries such as the United States and Germany, which were not developed in industry, to develop their industrial power, industry should be encouraged and protected. Friedrich List studied Hamilton's ideas in America between 1825-1832 and put forward his own doctrine (in "The National System of Political Economy" published in 1841) based on the information he obtained from there [22].

F. List focused on the infant industries thesis in his theory. It should be noted here that the dynamic productive forces theory (Theorie der dynamische produktiven Kräfte) put forward by F. List and his emphasis on the importance of human capital education and infrastructure in the development process have been of great importance (in the sense of being an example) in terms of countries being able to develop technology and accelerate their industrialization. The effects of F. List's ideas also influenced the administrators of developing countries in the twentieth century with their import substitution policies. Later in the literature, List's views were also defended by J. S. Mill (1806-1873), C. F. Bastable (1855-1945), G. Haberler, M. C. Kemp, W. M. Corden and many other economists [23].

However, as A. Kibritçioğlu's stated, the applicability of the policies F. List put forward for Germany and which were successful (within the logic of the protectionist infant industries thesis) is also debatable in today's global world. Because under global economic conditions, it is not possible for countries to implement protectionist practices. When viewed from this perspective, it seems that countries can compete in the world economy by developing technology, rather than protectionist policies, by developing countries' education and training systems and by supporting R&D activities through studies that can be implemented jointly by state institutions, universities and representatives of the industrial sector.

Conclusion

In the face of Britain, which made significant progress in industrialization in the 1600s, and Germany, which accelerated

industrialization in the 1800s, countries in most parts of the world did not have the same opportunities. While these countries were introduced to industrial products through imports, their production structures consisted only of agricultural sectors, small factories and artisan activities.

However, by the 1950s, industrialization quests and initiatives had begun in a significant portion of developing economies. These industrialization quests, which came to the fore in developing economies, were actually a quest to ensure the economic development of these countries, like developed economies, and expressed the desire to become a welfare society. It can be said that the 1950s, 1960s and 1970s were the years when developing economies focused on industrialization. However, 50 years after the 1950s, that is, in the 2000s, while industrialization was still a goal in developing economies, the world economy entered a new phase in industrialization with the focus on developed economies and prioritized technology in industrial development.

Now, in the 2000s, development in the industrial sector is more related to technology development. And this situation has meant the main differentiation between developed and developing economies. The 2000s were the years when the world economy transformed into a global economy, and the global economy and extreme competition that emerged in the 1990s formed the general appearance of the world economy in the 2000s. Under these conditions, developed economies focused on developing more technology in order to exist and compete in international trade. This orientation meant that these economies concentrated on R&D activities. Because the technological development that brings innovations depends on the increase in R&D activities.

In a sense, the 21st century for the world economy is a century in which the focus on R&D and technology has increased, based on the importance of knowledge. R&D studies, which mean a differentiation in terms of economies, have become even more important for developing economies that are already behind in industrialization. In the 1900s, these economies, which had to buy industrial products by selling agricultural products, have tended to buy technological products by producing and selling agricultural products and traditional industrial products in the new century. In fact, it is clear that the solution for these economies is to focus on research and development activities and turn to industrialization focused on knowledge (R&D).

However, in a world where protectionism is not possible to be implemented (under global economic conditions), it is clear that the solution will be a holistic approach as suggested by F.List. This is possible in two dimensions. The first dimension is directly related to the development of the education-training system. The second dimension is related to do cooperation of universities and the industrial sector, under the leadership of governments in order to increase R&D activities in economies. It must say that these activities which support to increase of R&D is an important solution option in global economy conditions, for develop industrial structures and competitional positions of developing economies.

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