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THE IMPORTANCE OF KEY ACTIVATION TECHNOLOGIES IN SMART STRATEGY EXPERT: THE EVALUATION OF EU COUNTRIES AND TURKEY

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ABSTRACT

This study aims to, in line with the Smart Specialization, evaluate the distribution of KETs, which are used by the EU countries and Turkey, by using country significance indicator. The country significance indicator, which is one of the indicators considered to capture the performance of a country in the production of new technological information, represents the share of exports of goods related to KETs in total manufacturing industry exports. The data set used in the study was compiled from the European Commission Reports and covers the years 2002-2015. The countries included in the data set reported by the European Commission (2018) are EU member states. In addition to these countries Turkey was included in the analysis as a developing economy. To make a general evaluation; in order for Turkey to end foreign trade deficit, to find a place in the global competition and to realize the development successfully by using smart specialization, effective use of Key Activation Technologies is needed.

KEY WORDS: Smart specialization, key enabling technologies, regional development.

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1. INTRODUCTION

Nowadays, regions and/ or countries aim to achieve their development successfully by increasing their global competitive power. Development is essentially about making use of the resources owned effectively. In the development process, first of all, the competitive advantages of the region and / or the country should be determined. These advantages can be in the form of infrastructure, human capital, innovation capacity, social and economic networks, physical and informational capital, natural and cultural heritage (Gardiner, 2003). In this context, the European Union's 2014-2020 innovation policy "Smart Specialization Strategies" (S3) "was published by the European Commission in 2009 and contains the results of the pioneering work of Foray et al. (Foray et al., 2009). It is based on the "Knowledge for Growth" report. Intelligent specialization is an innovative “European Union (EU)” strategy that aims to identify and develop the competitive advantages of the region and / or country (S3Platform, 2016). The strategy in question aims to increase the competitiveness and economic sustainability of the region and / or the country in the most efficient way. The Smart Specialization Strategy can be possible with the combination of the unique knowledge of the regional economy with high innovation potential.

“Key Enabling Technologies (KETs)”, one of the tools of the smart specialization strategy, is positioned as the main driving force for the development of industries (European Commission, 2012). Key Enabling Technologies (KETs) are technologies that allow European Union countries to increase their competitive power and realize their smart specialization. KETs, which contain high R&D and intensive knowledge, also provide global opportunities and qualified sustainable employment opportunities to the region and / or country. The most effective KETs created based on current global research can be listed as follows (European Commission, 2009; 2012):

- Biotechnology and Industrial Biotechnology
- Nanotechnology
- Advanced Technology Materials
- Advanced Production Technologies
- Micro and Nano Electronics
- Photon and Photonics Technology

The use of these technologies in the EU region is not only strategically important, but also indispensable for reasons such as reducing poverty, creating new markets, increasing energy efficiency, grasping global opportunities and providing high-skilled employment (European Commission, 2009). The main purpose of the EU is to create a leverage effect by combining its competitive advantages with KETs. Thus, the region and / or country will be moved to the top in terms of competitiveness among other regions and / or countries and smart specialization will be realized. However, since it is difficult to analyze the advantages that countries have in terms of their scarcity or multiplicity, the goods exported by a country are regarded as the closest value that shows the competitiveness of that country (Hidalgo and Hausman, 2009). The fewer and / or simple goods a country's export basket consists of, the country in question will not be able to rank at the forefront of international competition. Such countries should either discover a valuable raw material or invest in high-tech areas such as KETs in order to find a place in international competition (Turkcan, 2019).

As it is known, Turkey is undergoing a structural trade deficit problem for many years (Stale et al., 2013). It is considered that KETs can be used to get rid of the said structural deficit problem by improving Turkey’s exports. Initiatives for KETs are generally located in the industry sector, which is one of the three sectors of gross domestic product, and concentrates around the manufacturing industry sub-sector. As a result of the leverage effect of KETs with high innovation potential, it is predicted that both the realization of smart specialization and the foreign trade deficit problem can be solved. In this context, if the export of goods intensive in terms of KETs is emphasized, it will converge to globally developed economies (Şahbaz et al., 2014)

Therefore, this study, "Smart Specialization Strategy, (S3)", aims to assess the use of KETs by Eu countries and Turkey through distribution of manufacturing exports. The rest of the study is designed as follows: Chapter 2 addresses the conceptual framework. In Chapter 3, the data set is introduced. Chapter 4 includes discussions of the study. Chapter 5 ends the study with a general evaluation and recommendations.

2. CONCEPTUAL FRAMEWORK

The EU defines the concept of smart specialization, which is its investment policy, as a strategy that will shift the resources of the region to activities with competitive advantage by differentiating from other regions (S3Platform, 2016). If a region that includes traditional textile, agriculture and industry sectors determines which technology and / or technologies it should use to be more efficient, the region may become globally competitive. However, the region in question here should not be perceived as the "best region" and / or "the region with the technology leader".

In a highly competitive product produced by today's KETs, many technologies such as nano technology, advanced technology materials, advanced production processes, micro and nano electronics are brought together.

Biotechnology, one of the KETs that help to realize smart specialization, is essentially a term that describes the use of biological order and processes (TUSIAD, 2000). Biotechnology, a technology based on living organisms or biological systems; It uses food products, textiles, industrial and other necessary materials to produce more sustainably. Biotechnology has basic areas such as environment, industrial, medical, agricultural and animal husbandry, food biotechnology. The shares of products produced with biotechnology in world markets are; for the food sector (77%), for antibiotics (12%), for pharmaceutical-kit production (7%) and for the agricultural sector (3%) (Kolankaya, 2016).

Nano technology, on the other hand, is a technology that can be reorganized by changing the shapes of atoms and molecules and can create completely different shapes, occupies much less space, consumes less energy, and has cheap and functional features. If it is necessary to give an example of nano technology; It can be said that the atoms that are well organized on the molecules are transformed into a special fabric that can better protect against heat or cold (Celep and Koç, 2008). The technology in question can be used in areas such as health, energy and environment. In addition, 1 nanometer means one billionth of 1 meter. While the first humans had a limited number of materials, materials evolved and developed over time with the discovery of new techniques. Today, the presence of technology-intensive materials has gained importance. These advanced technological materials are used in various fields such as aviation, transportation and healthcare services. KETs are key areas

that determine the position of EU countries in the global market. Investing in these areas will increase competitiveness, create jobs and support growth. Micro and nano electronics are also required for all goods and services that need control in sectors such as automotive, aviation and space (Şenel, Gürbüz, & Koç, 2015). With micro and nano electronics, the production, storage, transportation and consumption of electricity are managed more efficiently. Photon and photonic technology is a field that includes light production and management. In order to create renewable energy with sunlight, a technological basis is created with various electronic components. Given the rapid progress in science and research, the above technologies could quickly become globalized in the coming years, and other new technologies may emerge.

3. DATA SET

The data set used in the study was compiled from the European Commission Reports and covers the years 2002-2015. The countries included in the data set reported by the European Commission (2018) are EU member states. In addition to these countries Turkey was included in the analysis as a developing economy. Therefore, twenty-nine countries (Germany, Austria, Belgium, United Kingdom, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Croatia, Netherlands, Ireland, Italy, Spain, Sweden, Cyprus, Latvia, Lithuania, Luxembourg, Malta, Hungary, Poland, Portugal, Romania, Slovakia, Slovenia, Turkey, Greece) are taken into consideration.

Countries should be able to export high-tech goods and services such as KETs in order to increase their competitive power. Initiatives for KETs generally take place in the industrial sector, which is one of the three sectors of gross domestic product, and concentrate around the manufacturing industry sub-sector. In this context, "Country Significance" indicator was used to represent the density of KETs in exported goods. The Country Significance indicator, which is one of the indicators considered to capture the performance of a country in the production of new technological information, represents the share of exports of goods related to KETs in total manufacturing industry exports. A high value in the indicator indicates that a significant share in the country's total manufacturing industry exports is reserved for exports of goods related to KETs. Therefore, it can be said that the country, which has a high level of country significance, is in an advantageous position in terms of the share of exports of goods related to KETs in total manufacturing industry exports. This advantage will also apply to

a country whose country significance tends to increase over time. Thus, it will gradually come closer to realizing its smart specialization.

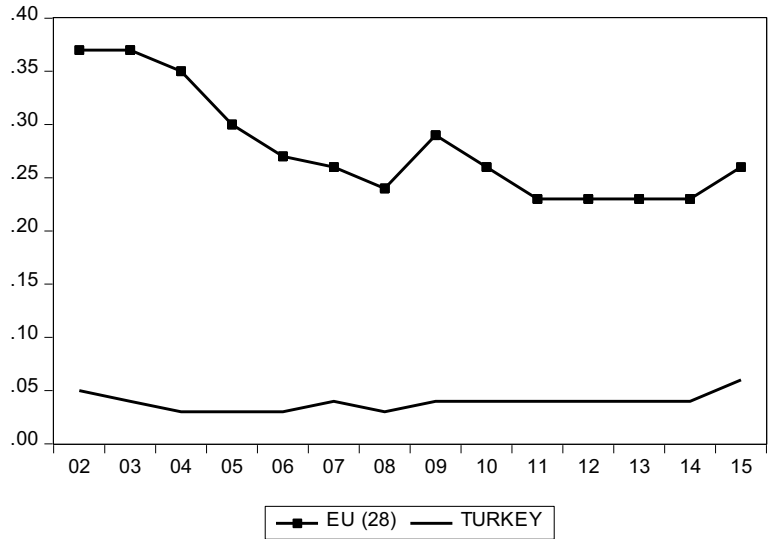
$$SG_{kit} = (E_{kit}/E_{it}) * 100 \quad (1)$$

In the equation (1) given above, (SGkit) represents the share of the export of the goods with which the relevant KET (k) is related in the year (t) for the country (i) in the total manufacturing industry export of the relevant country. Country significance indicators, were taken into consideration during the 2002-2015 period for each KET for Turkey and EU-28 average.

4. DISCUSSION

The country significance indicators that are calculated for industrial biotechnology, nanotechnology, advanced materials, advanced manufacturing processes, micro and nano electronics, and national significance photon photonics technology for Turkey and for the EU-28 average is presented below:

Figure 1: Industrial biotechnology country significance

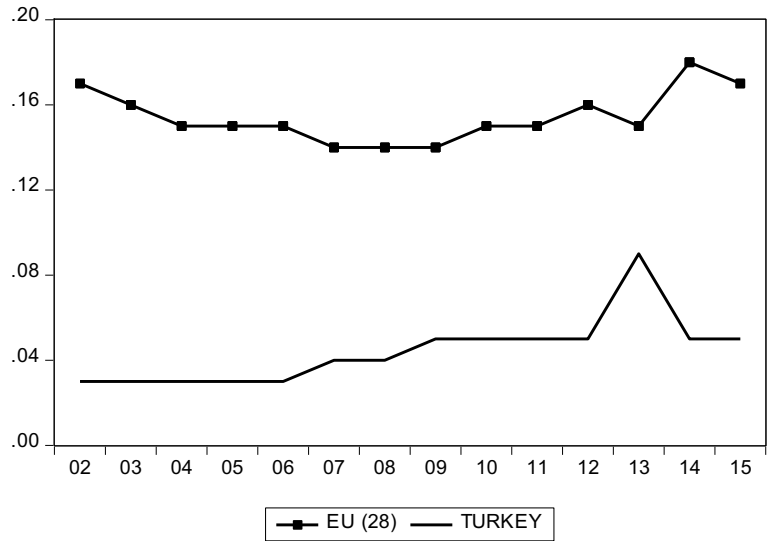


Source: ec.europa.eu (The figure is prepared by the author.)

As can be seen from the findings in Figure 1; industrial biotechnology significance for Turkey during 2002-2015 period, the country remained under a great deal of systematic EU-28 average. Industrial biotechnology country significance is 0.06 for Turkey in 2015 while it is 0:26 for the EU-28 average

level. While Industrial biotechnology significance of Turkey did not change, during the 2002-2015 period, there was a downward trend in the period 2002-2008 for EU-28. Thus, it can be said that Turkey, unfortunately, remains well below the EU-28 average in industrial biotechnology and a trend towards closing this deficit was not observed.

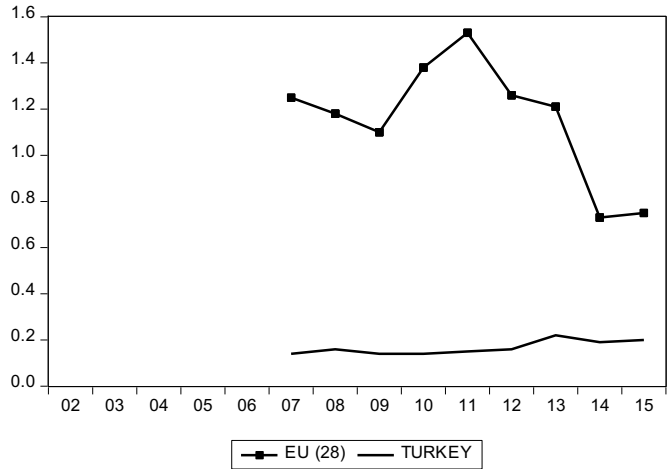
Figure 2: Nanotechnology country significance



Source: ec.europa.eu (The figure is prepared by the author.)

As seen in Figure 2, the findings show that nanotechnology country significance of Turkey during 2002 to 2015 was below the average EU-28 member states. Nano technology country significance of Turkey in 2013 had reached the highest level with 0.09, and 0.15 was realized for the EU-28 average. Nanotechnology country significance is frustrating, although in later years it showed a significant increase for the 2012-2013 period, Turkey has turned into a form of the old state. Despite this, nano technology country significance tends to increase from 2013 for the EU-28 average. Thus, Turkey's nano-technology significance, unfortunately, remains below the EU-28 average and said that the closure of this open attitude exhibited by the inadequate direction.

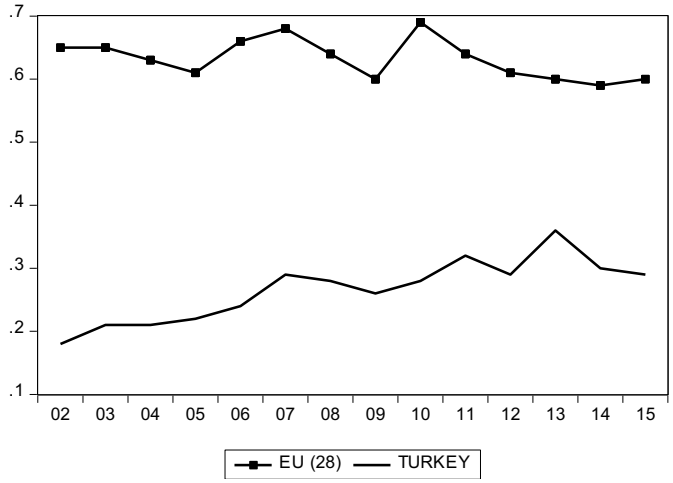
Figure 3: Advanced technology materials country significance



Source: ec.europa.eu (The figure is prepared by the author.)

As seen in Figure 3, Turkey systematically advanced technology materials for the 2007-2015 period the country is under a great deal of significance from member states of the EU-28. The pre-2007 data of the said KET could not be reached. High-tech materials country significance of Turkey in 2014 had reached the highest level of 0.19, was realized at the lowest level for the EU-28 with an average of 0.73. What is striking here is the country significance of advanced technology materials, Turkey remained unchanged for many, a downward trend during the 2010-2015 period, particularly in terms of the EU-28 is outstanding. Thus, Turkey on advanced technology materials, unfortunately, remains below the EU-28 average and a trend towards closing this deficit was not observed.

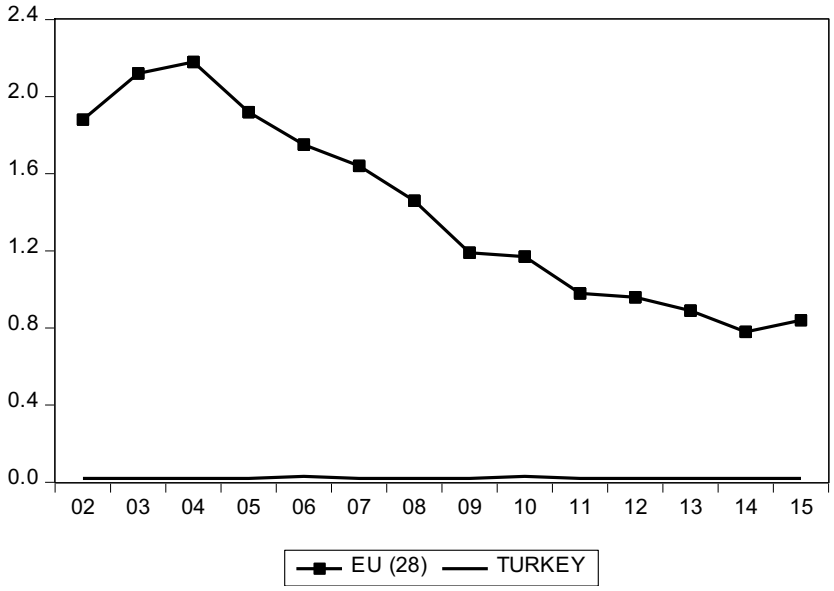
Figure 4: Advanced production technologies country significance



Source: ec.europa.eu (The figure is prepared by the author.)

As seen from the results in Figure 4, advanced production technology country significance for Turkey from 2002 to 2007, the period from 2009 to 2011 and from 2012 to 2013 remained below the trend but still tries to capture the EU-28 average. While the country significance of advanced production technologies was 0:29 for Turkey in 2015, was realized as 0.60 for the EU-28. The country significance of advanced production technologies, was on the rise in Turkey during the period 2002-2015, while the EU-28 average is unchanged. Thus, in advanced production technologies which remained below the EU-28 average, but said that Turkey's observed a trend toward closing this gap.

Figure 5: Micro and nano-electronics country significance

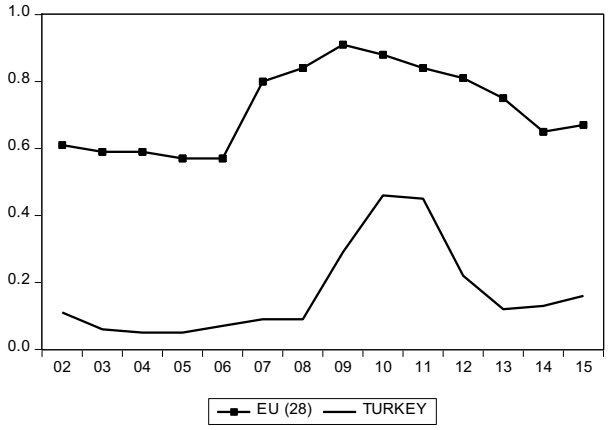


Source: ec.europa.eu (The figure is prepared by the author.)

As seen from the results in Figure 5, micro and nano electronics significance for Turkey in period 2002-2015 remained well below the EU-28 average. While the significance of micro- and nano-electronics is 0:02 for Turkey in 2015, was realized as the EU-28 average of 0.84. Micro and nano-electronics country significance is virtually zero in a disappointing way to Turkey during the period 2002-2015.

At the same time, for the EU-28 average, the country significance of micro and nano-electronics has decreased significantly between the mentioned years. Thus, micro and nano electronics significance of Turkey remains under EU-28 average and a trend is observed in the direction of closing this gap.

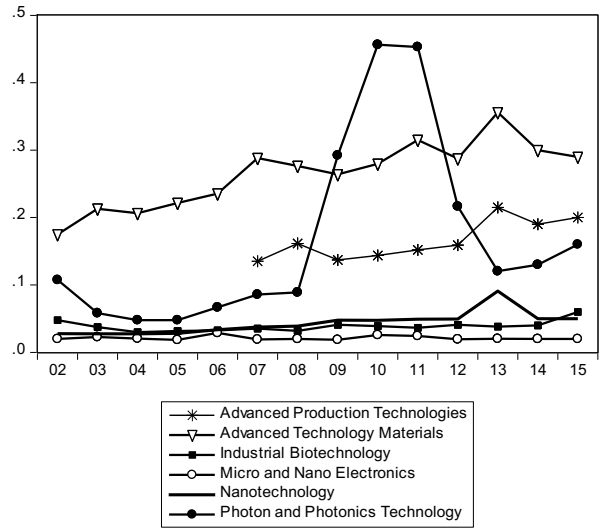
Figure 6: Photon and photonic technology country significance



Source: ec.europa.eu (The figure is prepared by the author.)

As seen from the data given in Figure 6, photons and photonics technology country significance for Turkey during 2002 to 2015 has fluctuated and remained below the EU-28 average. Photons and photonics technology significance was 0:13 for Turkey in 2014, a decrease of 0.65 was realized as compared to the previous year for the EU-28 average. Photons and photonics technology has provided increased country significance as promising for the period 2008-2010, but Turkey said the increase was insufficient to achieve the EU-28 average. Both for Turkey and EU-28 average significance of photon and photonics technology tends to decrease since 2011. As a result the photon and photonics technologies to remain below the EU-28 average, but said that Turkey's observed a trend toward closing this gap.

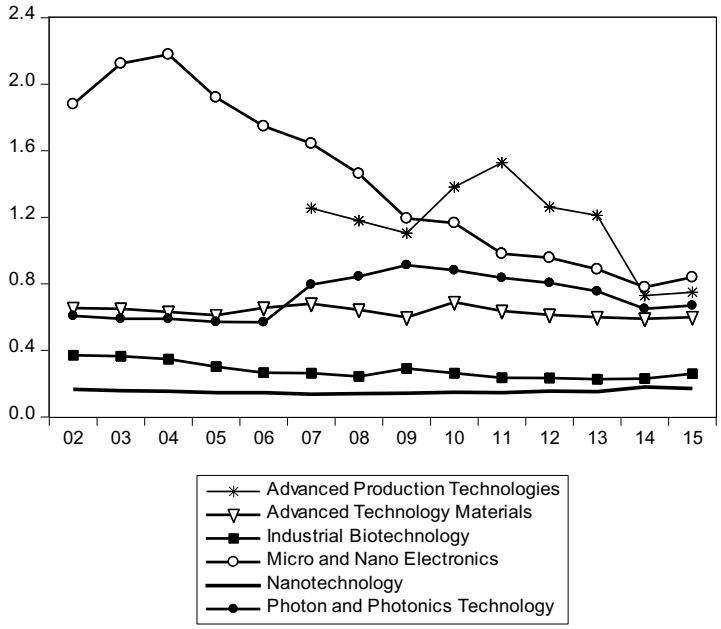
Figure 7: Country significance of KETs for Turkey



Source: ec.europa.eu (This figure is prepared by the author.)

The country significance of KETs for Turkey is given in Figure 7. As seen in Figure 7, the period from 2002 to 2015 for high-tech materials, it can be said that there is a relatively high significance of Turkey. On the other hand, a strong increase trend is observed in the country significance of advanced production technologies. According to Figure 7, it is seen that approximately 0.28 percent of the Turkish manufacturing industry exports were made up of products based on photon and photonic technology in 2015. In addition to this, Turkey's micro and nano electronics, industrial biotechnology and nanotechnology significance of the country is very low.

Figure 8: Country significances of KETs for EU-28 average



Source: ec.europa.eu (The figure is prepared by the author.)

The country significance of KETs for the EU-28 average is given in Figure 8. As can be seen from the findings given in Figure 8, it is concluded that the country significance of micro and nano-electronics is relatively higher for the EU-28 average in 2002-2009 and 2014-2015, and the country significance of advanced production technologies in the period 2010-2013. According to Figure 8, it is seen that products based on photon and photonic technology in 2015 constitute approximately 0.67 percent of the manufacturing industry exports in the EU-28 average. Besides, the industrial biotechnology and nano technology country significance of the EU-28 average is quite low.

5. CONCLUSION

According to Smart Specialization, which is an innovative European Union strategy that aims to develop by enabling the region and/ or country to develop its competitive advantages; The region and/ or the country can increase its competitive power and become economically sustainable by using the resources it has in the most efficient way. The industries that will change shape in the coming years are expected to consist of new goods and services, a significant portion of which is not yet known. “Key Enabling Technologies (KETs)”, the tool of the smart specialization strategy, are seen as the main driving force for the development of these industries. KETs, which contains high R & D and intense knowledge are technologies that help increase competitive power and realize smart specialization. These technologies can be listed as; biotechnology and industrial biotechnology, nano technology, advanced technology materials, advanced production processes, micro and nano electronics, photon and photonic technology. This study aims to, in line with the Smart Specialization, evaluate the distribution of KETs, which are used by the EU countries and Turkey, by using country significance indicator. The country significance indicator, which is one of the indicators considered to capture the performance of a country in the production of new technological information, represents the share of exports of goods related to KETs in total manufacturing industry exports. In this context, the KETs in Turkey during the years 2002-2015 compared to EU countries by effectively ballots remained well below the EU-28 average. To make a general evaluation; in order for Turkey to end foreign trade deficit, to find a place in the global competition and to realize the development successfully by using smart specialization, effective use of Key Activation Technologies is needed.

DISCLOSURE OF CONFLICT

The author declares that she has no conflicts of interest.

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