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INSTITUTIONAL WEAKNESSES OF UKRAINE'S
NATIONAL INNOVATION SYSTEM
AND THEIR CONSEQUENCES
FOR THE COUNTRY'S INTERNATIONAL
COMPETITIVENESS

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INTRODUCTION

Nowadays, amid the growing internationalisation of economic activity and international cooperation, as well as the dynamically progressing ICT revolution, an increasingly important role in the economic growth and development of countries is played by factors which did not use to be so important only a few decades ago. These undoubtedly include the quality of human capital, the level of development and the quality of so-called soft infrastructure responsible for the creation and diffusion of knowledge, the efficiency and effectiveness of institutions, as well as the innovation of the economy (Miozzo, and Walsh 2010). In addition, due to the changing structure of global demand, goods and services characterised by high technological advancement are becoming more and more important (Weresa 2014).

In view of the state of the modern world economy as discussed above, including above all the aforesaid increase in the importance of innovation and innovativeness, more and more often both economists and politicians in charge of the pursued economic policy try to take a systemic and comprehensive approach to the issue of creating an appropriate institutional system, adapted

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to the economic, social and political realities of a given country, conducive to innovation and innovativeness. Therefore, so-called National Innovation Systems are being created and developed, whose efficient and effective operation is intended to effectively increase the international competitiveness of their countries' economies (Joly 2017; Roland 2016; Weresa 2014, Weresa 2012a; Lundvall 2007).

This term was used for the first time by Ch. Freeman in 1987. In his definition, the National Innovation System (NIS) is a network of public and private sector institutions whose activities and interactions initiate, import and disseminate new technologies (Freeman 1987). In turn, Ch. Edquist defines NIS as all important economic, sociological, political, organisational, institutional, and other factors that influence the development, diffusion, and use of innovation in a given country (Edquist 2004). A detailed review of various ways in which this concept was defined has been carried out, i.e. by Weresa (2012), OECD (1997) and Nelson (1993).

For the purposes of this article, the National Innovation System shall be understood, using the Triple Helix concept (Etzkowitz 2008; Ranga, and Etzkowitz 2013), as a system of three interrelated sectors, i.e. the science and education sector, the enterprise sector and the government sector, which cooperate to develop an effective innovative environment within which innovations will be created and implemented in an open economy.

The main aim of this article is to identify and briefly discuss the main institutional weaknesses (institutional bottlenecks) of Ukraine's National Innovation System and to try to determine their consequences for the international competitiveness of the Ukrainian economy in the field of trade in high-technology and medium-high-technology goods, i.e. those which are created in industries based on knowledge and modern technologies, in the scope of which the creation and commercialisation of knowledge and innovation depends to a large extent on the efficiency and effectiveness of the National Innovation System. In other words, to check whether and how the competitiveness of Ukraine in trade in these goods is changing in the face of the certain existing institutional weaknesses of the National Innovation System implemented there.

A general assumption has been made that the occurrence and improvement of long-term comparative advantages in the export of a given country, especially in technologically advanced goods created in industries based to a large extent on knowledge and modern technologies, are a direct result of the efficiency of the operation of the National Innovation System implemented in this country, significantly shaped by the institutional solutions present there. The lack of such comparative advantages or the loss of those already

possessed may indicate serious institutional weaknesses of the entire National Innovation System, effectively reducing the effectiveness of this system, which will have a negative impact on the ability of the economy of a given country to create and commercialise innovative production solutions, thus reducing its international competitiveness in the field of technologically advanced goods. Of course, one should be aware of the fact that the efficiency and effectiveness of operation of the National Innovation System may be one of many factors determining this competitiveness.

This article puts forward a thesis according to which the lack of long-term comparative advantages in foreign trade of Ukraine in the field of high-technology and medium-high-technology goods, created in industries based, to a large extent, on knowledge and modern technologies, should be attributed to the strong institutional weaknesses present within Ukraine's National Innovation System, which – by significantly lowering this system's effectiveness – also reduce the ability to create and commercialise knowledge and innovation, which has a negative impact on the competitiveness of the Ukrainian economy in the trade of technology advanced goods.

The choice of the Ukrainian economy as the subject of research was not accidental. Ukraine's economic potential, as well as its geostrategic location, especially the political and economic context of its neighbourhood with Russia and the EU, mean that Ukraine is increasingly subject to various types of economic research and analysis. However, there is a definite lack of in-depth research on the international competitiveness of the Ukrainian economy, both in Polish and international economic literature, from the point of view of its shaping by the existing, albeit highly dysfunctional National Innovation System, considering the existing institutional weaknesses of this system. This article is intended to fill this research gap.

Moreover, the results of the research conducted as well as the recommendations made are important from the point of view of both Ukraine and Poland, Ukraine's direct neighbour, who cannot be indifferent to the country's development, which is greatly influenced by the competitiveness of the Ukrainian economy on the international arena.

1. LITERATURE REVIEW

The issue of international competitiveness of the Ukrainian economy in the context of the country's National Innovation System, considering the existing institutional weaknesses of this system and their consequences

for the competitiveness of Ukraine's foreign trade, is *de facto* not present in economic literature (both Polish and international). Although, for example, Falkowski (2018b) analyses the impact of institutions on Ukraine's competitiveness, his analysis does not take into account aspects related to the competitive position of the Ukrainian economy in international trade. This does not mean, however, that these issues are not subject to analysis or economic research separately from each other; on the contrary, although unfortunately a large part of them is not published in English, which significantly reduces their dissemination in the international scientific community. Below is a summary of valuable, in-depth studies on this subject, referring to the entire Ukrainian economy, published in English in recent years.

A comprehensive assessment of the competitiveness of the Ukrainian economy is carried out annually by the World Economic Forum of Davos in its annually published Global Competitiveness Reports. In the issue of this report from 2017, Ukraine was ranked 81st among 137 economies in the world (WEF 2017). Ravi and Vnukov also pointed out that Ukraine has much lower competitiveness than its potential would suggest (2014). Skavronska (2017) also draws attention to insufficient use or even 'wasting' of its potential, especially intellectual potential, from the point of view of the possibility and need to create the so-called creative industries in Ukraine, which would ultimately also significantly increase the competitiveness of the entire economy. Kharlamova and Gumenna (2018) also emphasise the need for Ukraine to take advantage consciously of its resources in the conditions of the digitalising modern world in order to build a creative, knowledge-based economy, which will be able to compete effectively on the international arena. In a similar vein, the need to transform Ukraine's economy from factor-led economy to an efficiency-led economy, without which it is impossible to effectively increase the competitiveness of the country's economy in the modern world, resulting in an improvement in its position in the international division of labour, was very clearly highlighted by the OECD (2012). An interesting analysis of competitiveness of the information economy industry in Ukraine was conducted by Ponomarenko et al. (2018). They came to the conclusion that one cannot disagree with it, namely that the fact that the Ukrainian state does not support high-tech sectors of the economy, such as information technology, is a strategic mistake as such support is a precondition for further development of these industries in the country, and it is these sectors that could become a driver of Ukraine's development as a whole and could contribute to improving the long-term

competitiveness of its economy. One of the important, even crucial, reasons of low competitiveness of Ukrainian companies on international markets is highlighted by Kolosok and Trusova (2015), who emphasise that a relatively large part of Ukrainian companies still use obsolete technologies, which leads to their weaker competitive position internationally.

Turning to selected scientific studies on Ukraine's National Innovation System, it is worth mentioning first the results of the research presented in the report entitled 'Peer Review of the Ukrainian Research and Innovation System', commissioned by the European Commission (EC 2017b). Its authors (experts from various countries) carried out a thorough, critical analysis of Ukraine's NIS, pointing to a number of difficulties in the operation of this system, which should first be eliminated in order to effectively increase the innovativeness and, consequently, the competitiveness of the Ukrainian economy. This report even clearly states that it is necessary to re-orientate the country's National Innovation System towards higher socio-economic significance and effectiveness, as well as a stronger focus on innovation. Yegorov (2008) derives the origins of the current problems with development and the efficient and effective operation of the existing, at least formally, National Innovation System in Ukraine not so much from the Soviet times but from the slowness of the Ukrainian authorities in the first years after the regaining of independence and the complete ignorance of this issue in the then pursued economic policy of the state. Fedulova (2015), who explicitly states that in Ukraine the problems of scientific, technological and innovative development have been ignored lately, articulated this problem even more strongly. A similar diagnosis is made by Yegorov (2015), according to whom Ukraine is plagued by little innovation activities and the fact that the gap between the industry and research institutions is widening, both in state and higher education institutions. Very similar conclusions are also drawn by Kasych and Vochozek (2017), who additionally suggest that in order to improve Ukraine's NIS, it is imperative to launch 'bottom-up' processes of innovation creation and thus reduce the role of the state (central institutions) in this respect, as is the case with the National Innovation Systems in developed countries. An interesting analysis of Ukraine's NIS from the point of view of its functioning within the framework of innovation infrastructure in the context of the key role it plays in the effective operation of the entire system was carried out by Kniazevych et al. (2018), who state that in the situation of current serious weaknesses in this infrastructure it is necessary to develop management mechanisms for forming and running the National Innovation System that would be based on the effective innovation infrastructure of

the country. In turn, Martovoy and Gagliardi (2011) note that over the last decades Ukrainian sectors of science and technology have changed considerably in an attempt to shift its scientific resources away from military towards civilian purposes and to improve its domestic capacity for advancing innovations. Despite that, they conclude, the Ukrainian system of innovation has not done well while the failure of Ukraine's NIS has contributed to the low level of innovation among Ukrainian companies.

2. METHODOLOGY AND DATA

In order to determine the significance of the existing, previously identified so-called institutional bottlenecks in Ukraine's National Innovation System for the international competitiveness of the Ukrainian economy, a general assumption was made that the existence and, more importantly, the improvement of long-term comparative advantages in international trade in technologically advanced goods (i.e. high-technology and medium-high-technology goods), created in industries based to a large extent on knowledge and modern technologies, are a direct effect of the effectiveness of Ukraine's NIS, which is significantly shaped by the existing institutional solutions.

It is worth noting that the concept of international competitiveness itself, due to its multidimensional and complex nature, does not have a single definition commonly used in economic literature. This is mainly due to different approaches taken to the subjective scope of competition as a whole and to its sources, as well as to the diverse systems of values followed by economists in defining it (Bhawsar, and Chattopadhyay 2015; Delgado et al. 2012). The definition of international competition has been synthetically reviewed, i.e. by Bhawsar and Chattopadhyay (2015), Misala (2014), Balkyte and Tvaronavičiene (2010).

However, for the purposes of discussing the issue being the subject-matter of this article what needs to be defined is a particular aspect of international competitiveness, namely the competitiveness of an economy in international trade. According to Carbaugh (2017), and this definition is applied in the article, such competitiveness is limited to the ability to develop, manufacture and sell goods and services that are more attractive in terms of price and/or quality than the export offer of other countries, which will have a measurable effect on the growing share of a country in the sale of these goods to other countries on international markets.

In order to verify the research hypothesis put forth at the beginning, to determine the competitiveness of the Ukrainian economy in contemporary international trade, and above all to identify potential comparative advantages in Ukrainian exports and their possible changes over the analysed period, the method of analysing Balassa's revealed comparative advantages (RCAs) (1965, 1989) has been applied, using the following formula:

$$RCA_{ij}^K = \ln\left(\frac{x_{ij}^K}{X_j^K} / \frac{x_i^j}{X^j}\right)$$

where:

RCA_{ij}^K – the revealed comparative advantages index of the K country for the i goods category in relation to the j country or a group of j countries

x_{ij}^K – exports of the i goods category from the K country to the j country or a group of j countries

X_j^K – total exports from the K country to the j country or a group of j countries

x_i^j – exports of the i goods category from j country or a group of j countries

X^j – total exports from j country or a group of j countries

i – goods category

K – the analysed country

j – the rest of the world

By using the logarithmic form of the above formula, we obtain positive or negative values of the RCA_{ij}^K indicators, which greatly facilitates their interpretation. We can speak of a revealed comparative advantage in exports of a given goods category only when its share in total exports of a given country is higher than the share of that goods category in total global exports, so when the $RCA_{ij}^K > 0$ (Falkowski 2018a).

With a view to testing the adopted research assumption, the competitiveness of Ukraine's exports of technologically advanced goods (i.e. high-technology and medium-high-technology goods) was analysed in detail. To this end, the OECD classification of basic goods categories based on their technological advancement was used (OECD 2011; Hatzichronoglou 1997). According to this classification, high-technology goods include the following subcategories: aircraft and spacecraft; medical, precision and optical instruments; office, accounting and computing machinery; pharmaceuticals; and radio, TV and communications equipment, whereas the subcategories of

the medium-high-technology goods category include: chemicals excluding pharmaceuticals; electrical machinery and apparatuses; machinery and equipment; motor vehicles, trailers and semi-trailers; and railroad equipment and transport equipment.

The analysed period covers the years 2001–2016 and all data used to analyse the subject-matter issue are derived from the United Nations Commodity Trade Statistics Database.

3. UKRAINE'S NATIONAL INNOVATION SYSTEM – AN ATTEMPT TO IDENTIFY INSTITUTIONAL BOTTLENECKS

In the case of Ukraine, from a formal point of view, we can speak of the existence of an elaborate National Innovation System. The core of this system are three main elements (corresponding to the Triple Helix concept), that is the R&D sphere, together with the educational base, responsible for the creation of innovations; the industrial sphere, responsible for the commercialisation of innovations; and the sphere of public authority, responsible for the creation and efficient functioning of the institutional system of regulations and rules of cooperation between the individual elements of NIS, so that the process of creation and commercialisation of innovations is carried out efficiently and without interruptions.

In order to understand the present institutional conditions of the National Innovation System in Ukraine, it is necessary to be aware of the fact that all the time, despite the fact that almost 30 years have passed since the collapse of the USSR, the Ukrainian economic system is to a large extent a conglomerate of institutional solutions (both formal and informal) from the times of the USSR and those introduced with various results during the never-completed transformation of the system in the times of the already independent Ukrainian state. As a consequence, even Ukrainians themselves refer to this system not as a 'rule of law', but as a 'rule alongside the law'.

Undoubtedly, from the point of view of efficient and effective operation of the National Innovation System, which is supposed to translate into gradual improvement of the innovativeness and competitiveness of the economy of a given country, the quality and transparency of legislation and its effective enforcement play an extremely important role. When analysing the legal system in Ukraine, several of its characteristics should be emphasised. First of all, the enacted laws and regulations do not have the status of mandatory standards in practice. Moreover, legal regulations may be changed arbitrarily,

often by a specific 'order' of a particular economic lobby or a group of politicians. In addition, they are very often 'vague' and 'unspecified', which, combined with the frequent lack of uniform interpretation of legal regulations and the multitude of institutions enforcing this law, constitutes a serious obstacle to the creation of long-term projects of cooperation between the R&D sphere and the industrial sphere. In addition, it also increases the uncertainty of doing business, including investment activities, also in the scope of venture capital, which is so important for financing new, ambitious and innovative start-up projects. Interestingly, in 2016 the value of venture capital financing innovative R&D projects was only 2.1% of the European Union's respective total R&D venture capital expenditures (EC 2017a). Moreover, the low efficiency of Ukraine's judicial system is also a serious problem. The independence and efficiency of the judiciary in Ukraine was rated so poorly by economists from the World Economic Forum that among 137 economies from all over the world, Ukraine was ranked only 129th (!) in the Global Competitiveness Report (WEF 2017). The inability to effectively safeguard rights, defend them against official decisions or enforce claims is a serious barrier to the development of Ukraine's National Innovation System.

The situation in Ukraine described above reinforces, on the one hand, the very strong significance of various informal ties on both economic and socio-political levels, and on the other hand, the instrumentality in the application and observance of the existing law, very often in the name of particular interests and benefits of civil servants, entrepreneurs and ordinary citizens. A direct consequence of this is the huge scale of corruption in Ukraine. Suffice it to say that in the Corruption Perceptions Index 2017, rating 180 countries and territories from all over the world, Ukraine was ranked as low as 130th (Transparency International 2017).

Another very important problem is that the institutional bottleneck of Ukraine's NIS is the issue of protection (or rather lack thereof) of intellectual property. It is absolutely unquestionable that in order to think about the effective creation and implementation of new innovative solutions in industrial production, it is absolutely essential to effectively safeguard the rights of natural and legal persons to benefit from their own creative work. This still has not been achieved in Ukraine, as evidenced by the country's position in the latest Global Competitiveness Report in the area of property rights protection, where Ukraine was ranked 128th out of 137 world economies, while in the area of intellectual property rights protection it was ranked only slightly higher, i.e. 119th (WEF 2017). Due to such a dramatic situation,

the International Intellectual Property Alliance has placed Ukraine on the Priority Watch List due to persistent deficiencies in its legal and enforcement regime, paying special attention to:

- 1) denial of adequate and effective protection of intellectual property rights,
- 2) failure to implement effective and systemic means to fight widespread online infringement of copyright and related rights,
- 3) unfair, non-transparent administration of the system for collecting societies (International Intellectual Property Alliance 2018).

From the point of view of the functioning of Ukraine's NIS, the actual lack of effective protection of property, including intellectual property, not only significantly excludes the possibility of using foreign technological solutions, but also effectively limits the possibilities of creating own, domestic innovations.

Another important institutional problem of Ukraine's National Innovation System is the way it is managed by the state administration, both at the central and local level. Despite significant improvements in this area in recent years, there is still, to a relatively large extent, overlapping and, on the other hand, paradoxical blurring of competences of various institutions (including the government) in the area of supporting pro-innovative activities in practice, despite the existing formal regulations in this area (On scientific... 2016). This obviously reduces the effectiveness of the state's pro-innovation efforts in Ukraine.

As regards the R&D sphere in Ukraine, especially the educational base, from the point of view of the existing institutional weaknesses determining the efficiency of the entire NIS in that country, one should pay attention to the absence of a clear and properly articulated vision of the development of the higher education sector in general and individual universities (Nikolaiev 2017), as well as to the quality and profile of education in Ukrainian schools and universities. Despite these changes, they are still largely out of step with the challenges of today's digital world. Therefore, in 2017 the law on education was passed, which is supposed to improve the situation in this respect. Interestingly, the need for a new law was justified (in 2017) by the fact that the previous law on education has long become obsolete, like the Soviet system of education it represented. Moreover, according to Ukraine Crisis Media Centre, the issues of academic integrity, corruption and nepotism in education are becoming even more pressing, there is widespread plagiarism, results of educational and scientific activities are fabricated and falsified. Schoolchildren complain about teachers' biased evaluation of their progress. External data can often prove these complaints, in particular by comparing

school ratings with the results of external independent testing in the same subjects (Ukraine Crisis Media Center 2017). The consequence is an increase in demand for private education, which can, however, be afforded by few and even mass emigration of young Ukrainians, especially from Western Ukraine, to study abroad. Between 2009 and 2016 alone, the number of Ukrainians studying abroad increased by 129%, reaching, according to official statistics, nearly 60,000 students, most of whom study in Poland, Germany and Russia. From the point of view of the Ukrainian economy, however, the problem is that later these young educated, creative people, not seeing their future in Ukraine, take up employment outside its borders, thus not increasing the active, educated labour resources in the country, which significantly lowers the pro-innovative human potential of the country.

Another issue is that although the existing network of various institutions and research centres in Ukraine is impressive (some of them operate under the auspices of the National Academy of Sciences, which, by the way, 'consumes' more than half of the public funds allocated to the R&D sphere with little impact on its activities on the Ukrainian market innovation), it is not reflected in the number of commercially available new solutions and products (Yegorov 2015). One may even come across an allegation that the Ukrainian R&D sector still functions as if alongside the economy, which significantly reduces its innovative potential. Aware of the existing realities in this area and in order to change it, the Ukrainian authorities have assumed in their new development strategy that financial and organisational support will be concentrated only in several selected areas, i.e. nuclear science, new materials, IT technologies, physics and astronomy, engineering, biotechnology, agricultural technologies and aerospace technologies (On scientific... 2016). One can only wonder whether such a wide range of priority areas of research will not have a negative impact on their actual results.

Still another important institutional problem in the National Innovation System in Ukraine is the transfer of knowledge between the R&D sphere and the industrial sphere responsible for its commercialisation, which is largely determined by legal (lack of clear regulations on how and with whom such cooperation can be undertaken) and financial considerations. Definitely, knowledge transfer to industry would be faster and better if R&D projects were commissioned and financed by the industrial sector. In 2015, BERD (Business Expenditure on R&D) in Ukraine accounted for only 18.7% of total R&D expenditure (World Bank 2017), which most clearly shows its very strong dependence on public funds from the state budget. What is also extremely important, the expenditures of Ukrainian companies on

innovations (innovative products) to a very large extent concern the purchase of machines, devices or software, based on existing technology; what is more, they are often imported goods, and do not result from the awareness and need to finance completely new, domestic modern innovative solutions. Recognising this problem, some leading research institutes have taken matters into their own hands and have already transformed themselves into research-production companies, which have preserved some R&D activities while creating a dozen of spin-offs that conduct business activities, including manufacturing of goods, on the basis of formerly-existing institutes. However, there are not many such examples among technology-oriented institutes in Ukraine (Yegorov 2015).

This is also connected with another issue. It should be noted that the economic transformation desired in the new geopolitical conditions, the privatisation process initiated, and attempts made, with varying results, to dismantle the planned Soviet economic management system in the early 1990s resulted in the disassembly of the existing post-Soviet economic structures in Ukraine, but unfortunately very often without the construction of new ones (Falkowski 2017). As a result, to a large extent the ability to create own innovative production solutions (industrial innovations with high added value) and to commercialise them has been effectively replaced by almost exclusively reproductive activity. A very good example of this can be found in the Ukrainian automotive industry, which was developing very dynamically during the Soviet era and has become, in fact, an assembly plant for foreign car brands during the independent period of Ukraine. Companies such as ZAZ or Bogdan Corporation assemble foreign cars, mainly Chinese and Korean ones. It is worth mentioning here that one glorious but only exception in this respect is the manufacturer of huge construction and specialist trucks (still hailing from the communist era) called KrAZ, which for many years have been in high demand mainly in the countries of the former Soviet Union, but also in the Philippines, Cuba, Indonesia, and are even sold to the USA.

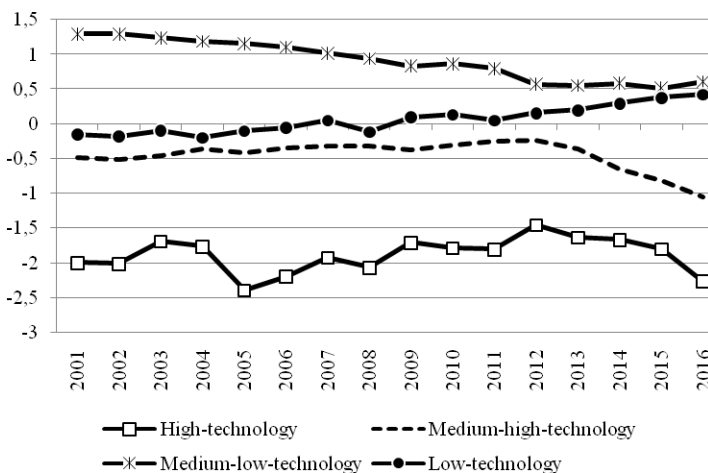
Taking into account all the institutional bottlenecks described above (institutional weaknesses), it is difficult to expect that the tried and tested solutions concerning the National Innovation Systems existing in the countries of Western or Central Europe and operating in diametrically different institutional conditions, will work in the same way in Ukraine, which would be reflected in the gradual improvement of innovativeness and, consequently, the competitiveness of its economy on the international arena.

4. UKRAINE'S COMPETITIVENESS IN INTERNATIONAL TRADE OF HIGH- AND MEDIUM-HIGH-TECHNOLOGY GOODS IN THE YEARS 2001–2016

The detailed analysis of the development of the comparative advantages disclosed in Ukrainian exports in the years 2001–2016 clearly shows that the country is competitive on international markets in the area of trade in medium-low-technology and low-technology goods (Figure 1). Moreover, it should be added that in the case of Ukrainian exports of low technology goods a gradual improvement in the competitiveness was observed over the analysed period (including recording comparative advantages since 2009). This was due to a very significant increase in the competitiveness of Ukrainian products from the food, beverages and tobacco goods subcategory (in 2016, Revealed comparative advantages – RCAs for this subcategory was 1.36, as compared to 0.42 in 2001). In the case of the traditionally most competitive goods category in Ukraine's foreign trade, i.e. medium-low-technology goods, there was a very worrying trend of gradual deterioration of their competitiveness in international trade. Although Ukraine still holds comparative advantages in trade in these goods, they very clearly decreased (from 1.29 in 2001 to 0.61 in 2016).

Figure 1

Revealed comparative advantages in Ukraine's exports within the basic categories of goods according to the OECD classification in 2001–2016



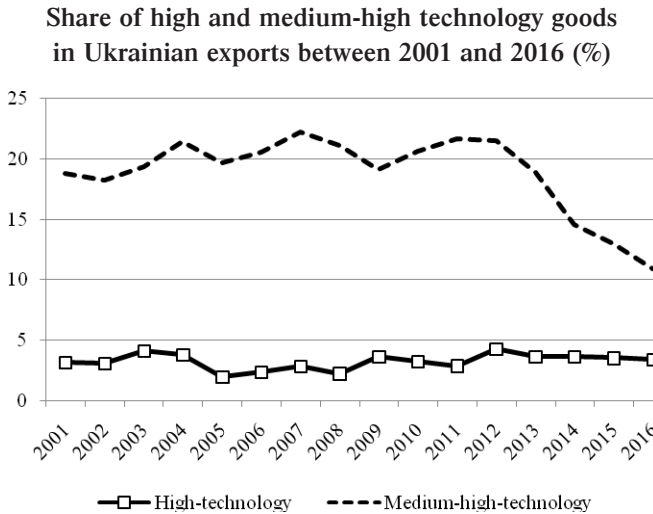
Source: Own elaboration based on data from the United Nations Commodity Trade Statistics Database.

This undesirable trend was the result of reduced international competitiveness of goods from Basic metals and fabricated metal and Coke, refined petroleum products and nuclear fuel subcategories (while in 2001 the RCAs for these subcategories were 1.81 and 0.81 respectively, in 2016 it stood at 1.12 and -1.59 respectively).

In turn, from the point of view of the research issue discussed in this article, particular attention should be given to the dynamics of the RCAs for high-technology and medium-high-technology goods (Figure 1). It appears that during the analysed period Ukraine did not have any comparative advantages in respect of goods from these two goods categories, which proves that the Ukrainian economy is not competitive in international trade in such goods. The situation is particularly bad in the case of trade in high-technology goods, for which the value of the RCA index in the analysed period ranged from -1.46 (in 2012) to -2.40 (in 2005). On the other hand, although the values of the RCA index were negative for medium-high-technology goods, in the years 2001–2012 they did not fall below -0.52 and were gradually improving (decreasing negative values of the RCA index). This was the case until 2013, when this trend was reversed and the RCA values for this goods category started to fall very sharply (an increase in the negative RCA values). Interestingly, a similar situation (in terms of direction and strength) was also observed in the case of high-technology goods. One of the main reasons for this was the collapse of trade with Russia in connection with the escalation of tensions in mutual relations, especially after the annexation of Crimea in March 2014 and accusations against Russia of supporting separatists in eastern Ukraine. It should be noted at this point that most Ukrainian goods, especially the medium-high-technology ones, were mainly exported to post-Soviet countries, mainly to Russia as they were not able to compete effectively on the demanding European markets because of both their quality and technological advancement.

In turn, if we look at the importance of high-technology and medium-high-technology goods in Ukrainian exports in the years 2001–2016, it will appear that in the case of the former ones it was rather minimal (Figure 2), with the share of this goods category in total exports ranging from 1.98% in 2005 to 4.26% in 2012. The importance of the latter ones in Ukrainian exports, on the other hand, was much greater, and their share in total exports over the years oscillated around 20% until 2013, when it began to decline dramatically. Suffice it to say that while medium-high-technology goods accounted for 21.58% of Ukrainian exports in 2012, in 2016 – only for 10.88%. The main reason for this has already been mentioned above.

Figure 2



Source: Own elaboration based on data from the United Nations Commodity Trade Statistics Database.

When analysing Ukraine’s competitiveness in the area of high-technology and medium-high-technology goods in international trade, it is worth exploring in more depth the development of the RCAs for the main subcategories of goods within each goods category in order to identify more precisely the level and scale of non-competitiveness of these goods in the international markets (Figure 3 and Figure 4).

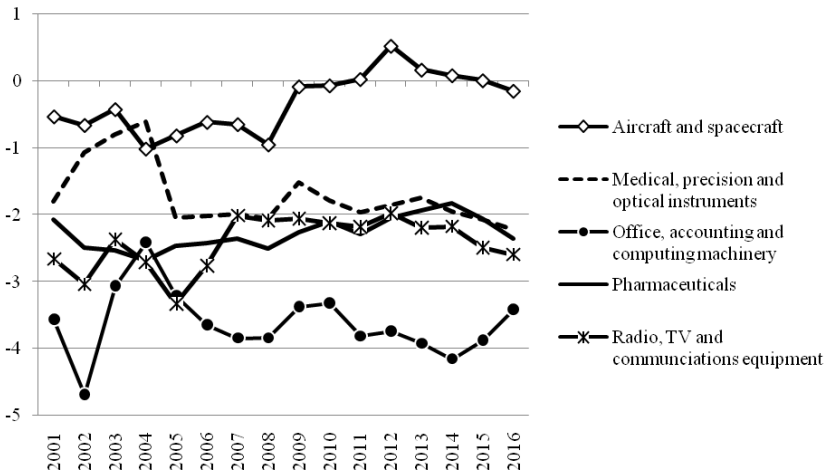
For the high-technology goods category, the trade in goods from the Aircraft and spacecraft subcategory looked relatively good during the analysed period, with Ukraine even recording comparative advantages in the years 2011–2015, which from 2012 onwards were markedly decreasing to reach a negative value in 2016 (RCA = -0.15). However, for all the other subcategories of this goods category, Ukraine has been very uncompetitive and has had practically nothing to offer on international markets for many years, as evidenced by the very high negative values of the RCA index for these goods subcategories (Figure 3). Ukraine is by far the most uncompetitive in the trade of goods from the Office, accounting and computing machinery subcategory (the average value of the RCA index for the years 2001–2016 is -3.62).

It is also worth noting that no improvement (with very few exceptions) has been observed in terms of the value of the RCA index for individual subcategories of goods within the high-technology goods category, which

proves that there has been no improvement in competitiveness within these goods, and partly also no improvement in the efficiency of NIS in Ukraine.

Figure 3

Revealed comparative advantages in Ukraine's exports within high-technology goods according to the OECD classification in 2001–2016



Source: Own elaboration based on data from the United Nations Commodity Trade Statistics Database.

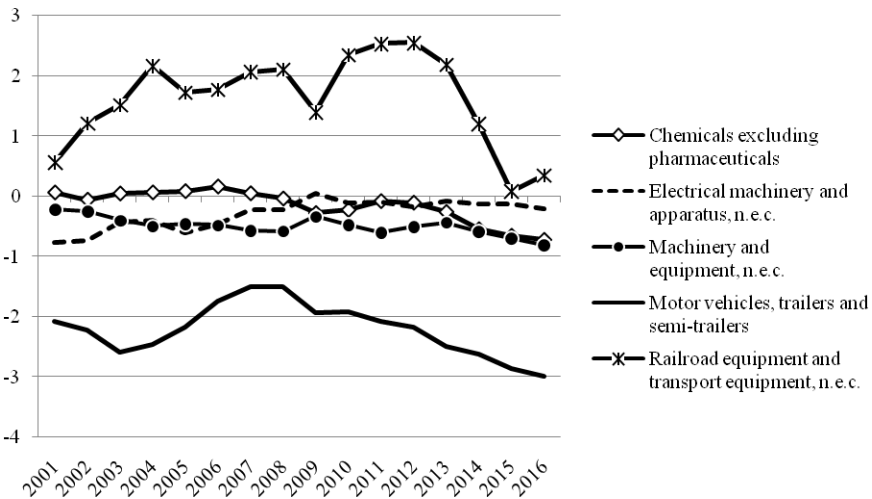
In the case of the medium-high-technology goods category, Ukrainian exports of goods from the Railroad equipment and transport equipment subcategory is characterised by the highest competitiveness (Figure 4). This export specialisation of Ukraine and its strong position, especially in the former USSR, gradually strengthened year by year in the analysed period, as evidenced by the growing values of the RCA index, to deteriorate sharply from 2013 onwards for the reasons already stated above. With respect to the other three subcategories of the medium-high-technology goods category, i.e. Chemicals excluding pharmaceuticals; Electrical machinery and apparatus; and Machinery and equipment, Ukraine did not have any comparative advantages in international trade (with the exception of Chemicals excluding pharmaceuticals in the years 2001–2007) although the values of the RCA index for these goods subcategories were relatively stable (the goods remained uncompetitive all the time) and ranged from 0 to –1. By far the worst situation in this respect concerns the goods from the Motor vehicles, trailers and semi-trailers subcategory, with respect to which Ukraine not only does not have any comparative advantages, but also the values of the RCA

index for this subcategory have been very dramatically decreasing since 2009 (the negative RCA is growing), which proves their growing uncompetitiveness in international trade.

Like in the case of high-technology goods, the fact that there has been no improvement in the competitiveness of Ukrainian goods in international trade is also very clearly noticeable here, and such a situation can and should be connected with the ineffectiveness of NIS in Ukraine.

Figure 4

Revealed comparative advantages in Ukraine's exports within medium-high-technology goods according to the OECD classification in 2001–2016



Source: Own elaboration based on data from the United Nations Commodity Trade Statistics Database.

CONCLUSION

The aim of this article was to identify the main institutional weaknesses of Ukraine's National Innovation System along with an attempt to determine their consequences for the competitiveness of the Ukrainian economy in the international trade in technologically advanced goods created in industries based, to a large extent, on knowledge and modern technologies, the development of which is strongly influenced by the efficiency and effectiveness of Ukraine's NIS.

The analysis of the development of the revealed comparative advantages in Ukraine's exports in the years 2001-2016 clearly shows that the country is competitive in the trade of medium-low-technology and low-technology goods, although – in the case of medium-low-technology goods – this competitiveness significantly decreased over the analysed period (as evidenced by the decrease in the relevant values of the RCA index). In the case of trade in high-technology and medium-high-technology goods, Ukraine proved not competitive on the international arena, which, from the point of view of the realities of the modern world economy and the ever-growing demand for goods with high and medium-high technology advancement, should be considered a clearly negative phenomenon. High-technology goods fared particularly badly in this respect. Moreover, for these two groups of goods in total, there was practically no improvement during the analysed period (except perhaps for the Aircraft and spacecraft subcategory); on the contrary, after 2013 the competitive gap in trade in these goods started to widen rapidly and substantially, which was also linked to the decrease of exports of these goods to the Russian market as a result of the deterioration of political relations between Kiev and Moscow.

All this leads to the conclusion that the strong institutional weaknesses present within Ukraine's National Innovation System, lowering the effectiveness of the entire system, effectively block the growth of the innovative capacity of the Ukrainian economy to create and commercialise knowledge and innovation, which translates into a lack of improvement in its competitiveness in international trade in technologically advanced goods, i.e. goods from the high-technology and medium-high-technology categories.

In this situation, it is fully justified to state that without the effective elimination of the existing (and identified in this article) 'institutional bottlenecks' in Ukraine's National Innovation System, it will not be possible to improve its economy's competitive position in international trade in technologically advanced goods, which is so desirable from the point of view of growth of the entire Ukrainian economy. Therefore, among the main recommendations for the Ukrainian authorities aimed to eliminate these institutional weaknesses and increase its economy's competitiveness in the afore-mentioned area, these should mainly be listed:

- (i) development and consistent implementation of a comprehensive and coherent long-term national innovation policy;
- (ii) creation of a transparent legal framework (including the elimination of inconsistencies) to ensure effective protection of intellectual property rights, as well as to secure the implementation of innovative projects at every stage, including their financing from private or public sources;

- (iii) development and implementation of policies to support long-term private innovation or start-up projects that require access to risk capital, an appropriate investment insurance scheme or the leasing of high-tech equipment;
- (iv) creation of efficient knowledge transfer mechanisms from research centres to industry, thus increasing the commercialisation of knowledge; and
- (v) undertaking an effective fight against corruption and bureaucracy in the country, both at the central and local levels.

Although at least some of these desirable measures will not be easy to implement, especially now, during the civil war in eastern Ukraine, amid the difficult macroeconomic situation and the lack of broad public support for the direction of political and economic changes in the current government formation, Ukraine, if it wants to become a more competitive economy in international trade, and thus more independent of the Russian economy, must make every effort to implement the above-listed measures to eliminate the institutional weaknesses that exist today in the National Innovation System implemented there.

From the point of view of further research on the international competitiveness of the Ukrainian economy in the context of institutional weaknesses of the country's National Innovation System, the need to determine the extent to which these institutional weaknesses are an important factor (as compared to others) shaping the ability and, consequently, the competitive position of the Ukrainian economy should be deemed fully justified. It should be checked whether this is the absolutely most important determinant or its importance in this context is not so crucial. This should be treated as a challenge and a direction for future, in-depth research on the competitiveness of the Ukrainian economy.

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INSTITUTIONAL WEAKNESSES OF UKRAINE'S NATIONAL INNOVATION SYSTEM AND THEIR CONSEQUENCES FOR THE COUNTRY'S INTERNATIONAL COMPETITIVENESS

Abstract

The aim of the article is to identify the main institutional weaknesses of Ukraine's National Innovation System and to try to determine their consequences for the competitiveness of the Ukrainian economy in terms of international trade in high-technology and medium-high-technology goods, i.e. those created in industries based on knowledge and modern technologies. In other words, to examine whether and how Ukraine's competitiveness in trade in these goods is changing in the face of the existing institutional weaknesses of its National Innovation System. In order to analyse the country competitiveness in international trade, B. Balassa's method of analysing revealed comparative advantages was applied.

The in-depth analysis of the dynamics of the revealed comparative advantages in Ukrainian exports in the years 2001–2016 clearly shows that the Ukrainian economy not only did not have any long-term comparative advantages in trade in high-technology and medium-high-technology goods in this period, but also its competitive position deteriorated in this respect. This should be attributed to strong institutional weaknesses within Ukraine's National Innovation System, which significantly lower the effectiveness of this system and also reduce the ability to create and commercialise knowledge and innovation, as reflected in the lack of competitiveness of its economy in trade in high-technology goods.

Key words: Ukraine, National Innovation System, institutions, international competitiveness

INSTYTUCJONALNE SŁABOŚCI NARODOWEGO SYSTEMU INNOWACJI NA UKRAINIE I ICH KONSEKWENCJE DLA JEJ MIĘDZYNARODOWEJ KONKURENCYJNOŚCI

Streszczenie

Celem artykułu jest wskazanie głównych słabości instytucjonalnych ukraińskiego Narodowego Systemu Innowacji oraz próba określenia konsekwen-

cji ich występowania dla konkurencyjności gospodarki Ukrainy w zakresie międzynarodowego handlu towarami z grupy wysokiej oraz średnio-wysokiej techniki, a więc tymi, które powstają w przemysłach bazujących na wiedzy i nowoczesnych technologiach. Innymi słowy sprawdzenie, czy i jak zmienia się konkurencyjność Ukrainy w handlu tymi towarami w obliczu istniejących określonych słabości instytucjonalnych Narodowego Systemu Innowacji. W celu analizy poziomu konkurencyjności Ukrainy w handlu międzynarodowym zastosowano metodę analizy ujawnionych przewag komparatywnych B. Balassy.

Z dokonanej pogłębionej analizy kształtowania się ujawnionych przewag komparatywnych w ukraińskim eksporcie w latach 2001–2016 jasno wynika, iż ukraińska gospodarka nie dość, że nie posiadała w tym okresie praktycznie żadnych długookresowych przewag komparatywnych w handlu towarami z grupy wysokiej oraz średnio-wysokiej techniki, to jeszcze jej pozycja konkurencyjna w tym zakresie się pogorszyła. Wiązać to należy ze znacznymi słabościami instytucjonalnymi istniejącymi w ramach Narodowego Systemu Innowacji Ukrainy, które znacznie zmniejszając efektywność owego systemu, zmniejszają także zdolność do kreacji i komercjalizacji wiedzy oraz innowacji, co znajduje swoje odzwierciedlenie w braku konkurencyjności jej gospodarki w handlu dobrami zaawansowanymi technologicznie.

Słowa kluczowe: Ukraina, Narodowy System Innowacji, instytucje, konkurencyjność międzynarodowa

ИНСТИТУЦИОНАЛЬНЫЕ СЛАБОСТИ НАЦИОНАЛЬНОЙ ИННОВАЦИОННОЙ СИСТЕМЫ УКРАИНЫ И ИХ ПОСЛЕДСТВИЯ ДЛЯ ЕЁ МЕЖДУНАРОДНОЙ КОНКУРЕНТОСПОСОБНОСТИ

Резюме

Целью статьи является представление основных институциональных слабостей украинской Национальной инновационной системы, а также попытка определить последствия их возникновения для конкурентоспособности экономики Украины в сфере международной торговли высокотехнологичными и среднетехнологичными товарами, то есть теми, которые имеются в наличии в отраслях, основанных на знаниях и современных технологиях. Другими словами, статья содержит в себе попытку анализа и оценки того, изменяется ли и каким образом конкурентоспособность Украины в сфере

торговли этими товарами, перед лицом существующих специфических институциональных слабостей Национальной инновационной системы. Для определения уровня конкурентоспособности Украины в международной торговле был использован метод анализа выявленных сравнительных преимуществ, предложенный Б. Балассой.

Проведённый углубленный анализ формирования сравнительных преимуществ, выявленных в украинском экспорте в 2001–2016 гг., наглядно демонстрирует, что, кроме того, что украинская экономика практически не имела долгосрочных сравнительных преимуществ в сфере торговли высокотехнологичными и среднетехнологичными товарами, в этот период наблюдается дальнейшее ослабление ее конкурентной позиции в данной области. Это связано с серьёзными институциональными слабостями, имеющими место в Национальной инновационной системе Украины, которые значительно снижают как её эффективность, так и способность создавать и коммерциализировать знания и инновации, что отражается в недостаточной конкурентоспособности ее экономики в сфере торговли высокотехнологичными товарами.

Ключевые слова: Украина, Национальная инновационная система, институты, международная конкурентоспособность

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