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ENABLING THE TRIPLE HELIX MODEL THROUGH THE IMPLEMENTATION OF SMART SPECIALIZATION: THE CASE OF UKRAINE

Introduction. *Euro-integration determines the need to harmonize the innovation policy of Ukraine in line with smart specialization (SS). SS is a quite new tool to facilitate knowledge-based growth in regions.*

Problem Statement. *SS aims at stimulating new economic activities that emerge at the intersection of interests of many different stakeholders. The SS implementation in Ukraine started from pilot activities in 3 regions, in 2017. Their results were not considered properly while incorporating SS into regional development strategies. Despite technical support from the European Commission, many regions were not able to change the policy making process and to ensure proper triple helix (TH) interactions. The under-involvement of the state in the process is among the reasons thereof, so the role of the state in SS has been explained in the paper too.*

Purpose. *The purpose of this research is to assess the SS implementation in Ukraine in the context of TH interaction between innovation stakeholders.*

Materials and Methods. *The study is based on the data obtained by the authors during the elaboration of smart specialization for Kyiv city and Kyiv Oblast, the analysis of the regulatory framework, as well as other analytical materials and research papers. The expert opinion generalization, content and statistical analysis methods have been used.*

Results. *The first steps in the implementation of the SS concept in the strategies of regional development have been assessed, the problems and ways to address them have been identified in order to facilitate the SS and to strengthen TH cooperation in Ukraine. The current situation with the implementation of SS has been analyzed. The analysis has shown paths for assessing the Ukrainian innovation capacity, international developments, and the development of the existing essential tools to control the progress in the promotion of smart specialization in the country. The report on the development of SS in Kyiv and Kyiv Oblast with an emphasis on the problems related to the involvement of stakeholders has been prepared.*

Conclusions. *The key barriers for the SS implementation, namely, inconsistency of the legislation, underdeveloped innovation and industrial policies have been identified and the ways for overcoming these barriers have been proposed.*

Keywords: innovation policy, triple helix, smart specialization, and regional strategy.

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The national economy competitiveness depends largely on the effectiveness of innovation policy, and that, in turn, on the interaction between government, science, and industry. The implementation of the so-called "triple helix" (TH) concept of interaction in the system "government — science — manufacture" has become one of the tools for improving the efficiency of innovation activity. The first model based on this concept was proposed about a quarter of a century ago and has been actively developing in recent years. The studies are focused on interrelations between the main actors of innovative activity [1—3]. The problems of combining the efforts of public institutions, R&D organizations representing different sectors, and companies in the advanced economies, in particular, in OECD member states, have been discussed in many publications and policy documents (see for instance, [4]).

Ukraine is one of the largest countries in Europe, ranked 2nd by the area and 9th by the population. Meanwhile, its economic performance has been rather poor in recent decades, GDP is still lower, than before the independence in 1991. At the same time, most of the Central and Eastern European countries, including the post-Soviet ones, have been demonstrating better results. The unsuccessful economic development of Ukraine was accompanied by a drastic transformation of research and innovation systems. The detailed description is given in NATO Science Series book [5], Yegorov [6], and other publications.

The country started process of administrative reforms in the 2010s with a special focus on the decentralization of managerial functions between the center and the regions. This has led to the introduction of new policy instruments, including the development of smart specialization.

SMART SPECIALIZATION AND THE TRIPLE HELIX CONCEPTS

Smart specialization (SS) has become a popular concept in the EU countries in recent years. Initially, it emerged in 2009, as a response to the economic crisis, while the Triple Helix concept was proposed in the mid-2000s. Some scholars have stated that the TH concept needs to be taken into active use in a modern way, including expanding to the Quadruple Helix [7]. SS is considered a major contributor to operationalize the TH concept [8].

The SS concept itself was prepared as a reaction to challenges of the globalization. Initially, it's founder D. Foray and his colleagues considered smart specialization strategy (S3) an instrument to fight crisis by developing corresponding tools for the creation of favorable conditions and relevant instruments for boosting economic growth in a particular region or country [9]. The S3 Methodology aims at stimulating new activities that emerge from the connections between and integration of the knowledge of entrepreneurs, specialized services, local universities, and public research organizations, etc. to explore and to open new opportunities. Smart specialization has the two key goals:

a) to build capabilities through the exploration of a new domain of opportunities;

b) to drive structural change (modernization, etc.). This is not a simple task, especially for such countries, like Ukraine. There are the two main problems related to analysis. On the one hand, SS deals predominantly with the regions, not the countries. So, it is expected that in Europe more than 120 regions have to formulate and to implement their smart specialization strategies in 2016—2020 [10]. On the other hand, some countries also prepare their own strategies. Such approach looks rational, especially for less developed countries outside the EU, as coordinating the development in the situation of limited resources is among the key objectives of the local and central governments. The second problem is how to harmonize S3 with other policies. It is evident that Smart Specialization has to be based on innovation. However, S3 also requires a broad-based policy effort focusing not only on STI policies, but also on accompanying them with the upgrade of institutional capacity, structural reforms,

and investment in human capital. In addition, beyond economic growth, innovation policies need to meet broader societal challenges [11]. This determines whether the growth is sustainable and inclusive in the context of decarbonization, the transition to a circular economy, growing interpersonal and territorial inequalities, and the transformations brought by digitization, demographic change, and new work and consumption patterns. In the EU countries, this means building on research excellence to bring innovative solutions to market, at home, and abroad, and piloting solutions that reflect the diversity of societies and territories [12].

According to the approach proposed by the EU experts for the assessment of country's capacity for the preparation and implementation of S3 [13], Smart Specialization Strategies should be designed in six steps, each of them is assessed with the main critical factors:

1) Analysis of the regional/national context and capacity for innovation

(regional/national assets, outward dimension and entrepreneurial dynamics);

2) Governance (*governance structures, broad participation management and communication*);

3) Shared Vision (*broad view of innovation, grand challenges and scenario analysis*);

4) Identification of priorities (*revision of past priorities, consistency and critical mass*);

5) Policy mix, roadmaps, and action plan (*roadmap, balance and framework conditions*);

6) Integration of monitoring and evaluation mechanisms (*output and result indicators, monitoring and RIS3 update*) [14].

To some extent, it is similar to SWOT analysis at political level. The key directions of the analysis are determined by the EU experts, and they are common for all countries and regions. To present a huge amount of information in one visual modality, the experts use the so-called S3 (or RIS3) Assessment Wheel.

The state plays a central role in the implementation of S3. It establishes the general rules of the game for all actors, and it is responsible for modifying these rules while implementing the strategy. At the initial stage, the state creates favorable conditions for smart specialization by providing fiscal and organizational incentives for businesses, public procurement, support of educational and training programs, and so on. However, these steps could not be adequate for successful development in the right direction. In this case, the state has to correct existing measures by modifications. For instance, it could be new tax cuts, provision of land free of charge or at a minimal price for new production sites, investment in infrastructure, start of new educational programs in the public universities, special scholarships for talented students and other measures, support of export by negotiating better conditions for national (and regional) producers. The leading modern specialists on innovation and industrial policy have stressed that much of the free market innovation machine rests on public support to research, development and innovation [15] and the role of the state in transformation of developing economies is growing [16].

THE UKRAINIAN COMPOSITION OF THE TRIPLE HELIX

Ukraine has been trying to utilize the best international practice in its attempts to modernize the national economy since gaining the independence in 1991. However, an important problem of ensuring innovation-driven development is the discrepancy between the declared goals and the actual implementation of policy measures. The official documents and legal acts in most cases do not clearly reflect the real problems in the innovation and research spheres. The proclamation of the need for innovation-driven development is not supported by specially designed measures, in particular, the use of effective mechanisms for the implementation of the results of innovation activities. The issues of improving the business environment, reforming the research system, developing and implementing a coherent R&D and innovation policy have been covered in various government documents, but specific measures to

address the urgent problems of innovation-driven development are not always carried out [17].

The signature of the Association Agreement with the EU imposes on Ukraine the obligations to harmonize activities in the field of science, technology, and innovation, and the Agreement on Associate Membership in the EU Framework Program on research and innovation *Horizon 2020* increases the relevance of problems related to improving the efficiency of R&D and innovative activities.

It is important to stress that the TH model provides a theoretical basis for a limited number of studies in Ukraine. This may correlate with the modest role played by universities in innovation processes, and weak ties between most universities and companies, public research centers, and between public research institutes and companies. In principle, most studies of the triple helix model in Ukraine are based on several double helix models: cooperation between universities and industry or government and industry, which are considered to represent the situation in the country more accurately than full-fledged triad models of interaction between universities, industry, and government. Elements of "partial" triple helix models exist only in some sectors, they display the serious difficulties associated with innovation policy in Ukraine, and also reflect a significant fragmentation of the innovation system of the country. Cooperation with EU partners is an important direction for the transformation of the scientific and innovation sphere, as it may bring the necessary experience and help to compensate for existing shortcomings, in particular the lack of relationships between the key actors, thus accelerating the emergence of the "triple helix" model in Ukraine. Stronger links and interaction between advanced knowledge and areas of its implementation may serve as a catalyst for the development of stable innovation environment [18].

Also, Yegorov and Ranga have examined Ukraine's innovation landscape from the standpoint of the Triple Helix system with regard to each component: knowledge, innovation, and consensus spaces. They have found that *the core elements of each space are in place in Ukraine and can provide the basis for functional Triple Helix innovation if further consolidated,* focusing more on innovation and industries space which is in infant phase [19].

The Ukrainian industry came through deep crisis in 1990s and 2010s. Most of large companies have lost their research units, and it is difficult to expect that they are able to resume its research activity. Meanwhile, few new and dynamic high-tech companies have emerged in Ukraine, but they are oriented mainly on international markets. On the other hand, IT sector is playing a growing role in the national economy. It has comprised about 40% of the national export of services, although transportation of energy resources via pipe-lines still has the largest share.

Universities are playing role of mostly learning institutes in the country. However, they have a relatively high number of local patents and utility models. The transformation of these universities into entrepreneurial universities may change the situation substantially [20].

Public research institutes are main players in R&D. The existing instruments of R&D and innovation support (private foundations, technology parks, science parks, business-incubators, and, etc.) are relatively poorly equipped and developed, personnel are not trained adequately and, most importantly, financial resources for support of innovation activities are scarce. Recently, the situation in the ICT-related innovations has improved. However, it is due to its orientation mostly on global markets, which makes ICT attractive investment worldwide. So, the ICT innovation ecosystem has been now more or less developed [21]. Another problem is that the traditional sectors, including natural resources-based sectors (ferrous metallurgy, coal-mining, energy generation and power engineering, basic chemicals, agriculture) dominate in the national economy and exports. These sectors have a more stable technological base and they are traditionally less active in innovations than high and medium tech

sectors, which contributes to an overall decline in the number of innovative enterprises. In any case, bearing in mind the size of enterprises of these sectors, they play the most visible role in innovation activities. Lack of incentives in modernizing the national economy and insufficient incentives for developing high tech sectors are among the key problems of the country.

In the years of independence, more than 80 different legislative acts were passed through Ukraine's parliament or issued by government in 1990s and 2000s. The next round of updating the S&T and innovation legal framework started in 2014—2015. The key legislative acts in the sphere of S&T and innovation, such as the laws on Innovation Activity, on Special Regime of Innovation Activity of Technological Parks, on Scientific Parks, on State Regulation of Activity in the Sphere of Technology Transfer and some others have been being revised. The Strategy for the innovation sphere development was approved by the government in 2019 and now the corresponding annual action plans have been approved as well. However, the COVID pandemic of 2020—2021 postponed the implementation of some measures for an indefinite period.

In general, the horizontal and vertical measures of industrial, innovation, and S&T policies are not coordinated well in Ukraine. Although the horizontal public inputs, such as the provision of education, lowering costs of starting up business, and some others are at the satisfactory level, the market horizontal inputs (R&D tax credit, training subsidies, other financial measures) have not been working in Ukraine. Similar situation is with the vertical inputs. The Ukrainian government provides thematic funding for some R&D, it supports the creation and operation of technological consortia and new forms of industrial activities and so on. The vertical market inputs, including support of specific sectors (defense, first of all), public procurement, and other similar instruments have been less developed in recent years. The measures to stimulate building of links between academia, university, business, and government are not well-developed (e.g. innovation vouchers, joint R&D projects). There are few examples of the National Academy of Sciences (the NAS of Ukraine) calls for partnership with business and its financial contribution. However, the main problem was a poor coherence in the implementation of corresponding instruments and insufficient funds for applied-oriented research. To find a balance between different measures, it would be advisable to try to introduce some of them in an experimental form.

The triple helix issues have been partially addressed in the national legislation on the development of regional strategies and innovation policy in Ukraine.

There is multilevel innovation priorities system that includes the strategic priorities (for 10 years) and the midterm priorities at the national, industrial, and regional levels.

To identify the regional mid-term priorities of innovation activities, work commissions should be set up by the regional authorities. These commissions involve representatives of different stakeholders, namely regional government, researchers of regional branches of the National Academy of Sciences, representatives of universities, managers and experts of leading companies in the region. This is fully in line with the Triple Helix concept. However, in reality, the representation of business is rather low and their voice is limited by few companies that have good relations with regional governments. Broader participation is foreseen during the development of regional strategies. So, majority of regions has set their own goals according to the national strategy, but the implementation is rather poor in the context of cooperation between science, business, and government. In fact, regional governments often ignore the need to identify regional innovation priorities [22].

At the end of 2018, the government of Ukraine introduced changes to the methodology for the preparation of the national strategy of regional development by incorporating smart specialization concept into it. So, now all regions have to

develop at least one strategic objective on the basis of smart specialization. It means that broader participation of stakeholders from business, in particularly SMEs, university, and government shall be secured, at least, during the entrepreneurial discovery process.

Thus, the Ukrainian government is trying to stimulate the development of cooperation between different actors of the TH model through smart specialization.

ASSESSING THE UKRAINIAN R&DI SYSTEM ACCORDING TO S3

During the period of independence, Ukraine has tried to adjust its S&T and innovation system to new realities of market economy. However, the economic crisis and political problems in the post-Soviet years had a negative effect on R&D and innovation. According to the State Statistical Service of Ukraine, the share of GERD dropped to the record low level of 0.41% in 2020 from more than 1% in the middle of the previous decade. Bearing in mind a quick devaluation of the national currency and an overall drop in GDP (by more than 15%) in 2014—2015, this means a substantial decline in the national R&D funding in real terms. Some recovery in financing of R&D and innovation was reported in 2016—2020, but the growth was not strong enough even to reach the level of financing of 2013 (in real terms).

The share of internal sources of local nongovernment investors in R&D has shown a tendency to grow, while the importance of other sources (state budget and foreign investors) has declined in recent years. As to the distribution of R&D expenditure, the business sector plays a leading role (56.4% of total expenditures) followed by the government sector (37.8%) and the higher education sector (5.8%). The private nonprofit sector neither plays any important role as an R&D contractor nor is a source of funding. In general, it is evident that the R&D expenditure in Ukraine (both in absolute and relative terms) is much lower than in the majority of the EU countries, especially in the case of that of the business sector.

Ukraine has a long tradition of collecting data on innovation activities. However, these statistical data are focused predominantly on the industrial sector. In recent years, State Statistical Service of Ukraine has also started conducting CIS-type surveys of innovation activities in line with the Eurostat methodology. According to the data from both sources (CIS- type survey and the conventional survey of innovation in industry), there has been reported a decline in innovation activities in the Ukrainian economy. In 2012—2015, the share of innovation enterprises in industry dropped by more than a fifth, while the expenditure on innovation fell by more than half during this period (in real terms). The situation has improved slightly since that time, but it still remains complicated [23].

The latest comprehensive "independent" surveys of Ukrainian innovation system were made by groups of international specialists of the World Bank in 2017 [24] and the United Nations [25]. They have shown that, although R&D and industrial potentials had been shrinking in the previous twenty-five years, Ukraine still had capacities for the innovation-driven modernization of its economy. For instance, as the publication analysis shows, the country is still a relatively strong player in new materials, space and aeronautics research sectors, especially as compared with other countries of the region [26].

As to the quality of human capital, Ukraine inherited a relatively well-developed educational system. Now, more than 70% of school graduates enter universities. However, serious concerns have been raised regarding the quality of education in technical and natural sciences. According to the Round University Rankings by *Thomson Reuters*, only few Ukrainian universities with specialization in technical and natural sciences were in TOP700 universities of the world during 2016—2021: *Igor Sikorsky Kyiv Polytechnic Institute* National Technical University and Kharkiv Polytechnic Institute [27]. It is also worth to mention that the highest position of Ukrainian university (Taras Shevchenko National Univer-

sity of Kyiv) was in TOP500. To great extent, this is due to the economic crisis and the limited supply of job places for university graduates in industry. The universities have limited interaction with the industry. Since mid-2000s, the number of graduates has declined by one third for natural sciences and by more than one fifth in technical sciences, while that in humanities and arts has grown by 5%, and that in social sciences, business and law has increased by 45%. It is not easy to assess the pool of researchers, as the country does not use full time equivalent (FTE) indicators. However, the number of researchers decreased more than 3 times in last 25 years, according to our estimates. The majority of research personnel is concentrated in the state institutes, while, on the other hand, more than 70% of doctor degree holders are involved in the higher education sector.

The state fiscal system provides the central government bodies with the bulk of tax revenues, thereby making the local authorities heavily dependent on Kyiv. As a result, research and innovation policies are mainly directed from the central ministries, although the local authorities also have some tools to exert influence, especially on local universities and research organizations. There is no singular body at the regional level that is responsible for R&D development. Some regional administrations have created special departments responsible for S&T and innovation policies. The NAS of Ukraine has six regional research centers, each coordinating research activities in various disciplines. The Ministry of Education and Science has 19 centers of S&T and economic information in different regions (oblasts) of the country. They may provide information and advisory support on S&T and innovation policies for regional authorities and companies. Kyiv remains a leader among the regions of Ukraine in terms of research and innovation. The city has several development programs that contain research and innovation components. The key measures of these programs focus on the modernization of urban infrastructure. Thanks to the efforts of the programs, several hundred research and innovation projects have been implemented in recent 10 years. Also, Odesa, Lviv, Dnipro, Kharkiv, and some other large cities have substantial innovation and industrial capacities.

The Ukrainian authorities have proclaimed their commitment to renewing the research and innovation infrastructure. A special government program was prepared in 2008 [28]. However, this program did not receive financing for its implementation. Later, attempts to re-start it were not successful either. A substantial part of the research infrastructure has been lost in the period of independence. Many institutes have no financial resources to upgrade their equipment, thus the rate of its renewal was not higher than 2—3% per year in the 1990s—2010s. The situation started changing slightly in the second half of the 2000s, but it is still difficult to find modern research devices and instruments in required quantities in Ukrainian research institutes. The obsolescence of research infrastructure is particularly evident in natural and life sciences and in some engineering disciplines. For equipment being expensive to replace, the institutions seek ways to extend the life of existing devices. It is clear that government action is required to reverse the deterioration trend in the research system, but it seems that resources are very limited.

The majority of supporting measures in R&D and innovation are not sector specific. However, the country has tradition of initiation of so-called S&T programs in different areas. They correspond with the priority areas of the development. The key problem in the past was a large number of these programs and their permanent under-financing. It could be a reason for a low interest to such programs from the business side who didn't want to participate in project with no guarantee to get funding. Since the early 2010s, the initiation of new programs has been strictly limited. Some of them are still under execution, including a program in the sphere of nanotechnologies. However, the level of financing remains relatively low, and, as the surveys have shown,

international grants are playing a growing role. Companies rarely take part in such competitions, but they are trying to explore opportunities related to the innovation project support within industrial parks or science parks. The bulk of money is invested in agriculture, food industry, banking sector, and some infrastructure projects rather than in high tech sectors. Ukraine needs more investment and technology transfer associated with it, in its industrial sector, especially in manufacture. According to different surveys of innovation activities, the lack of financial resources is the key barrier for innovation. At the same time, it is evident that numerous institutions that have to facilitate innovation development are inefficient [29]. Ukraine needs much more institutions that would have potential to finance innovation sector. It would be also important to provide not only short-term, but also long-term or, at least, medium-term loans for boosting innovation activities. Self-employment is common in the country but it is difficult to assess its real size, as more than 40% of the national economy is in the shadow.

Ukraine took part in the official estimate of the indicators for the Innovation Union Scoreboard in 2016 for the first time [30]. The country possessed a modest place at the very bottom of the list, according to the meaning of Innovation Index. Ukraine is performing well below the EU average for nearly all dimensions and indicators with exception of the indicators related to the level of education. Ukrainian government organizations follow the definition of innovation, as proposed by the OECD in Oslo Manual. It includes not only technological but also marketing and organizational innovations. The new forms of innovations according to new version of Oslo Manual 2018 [31] are expected to be included into the national statistics soon.

According to the applicable legislation, the priorities of S&T and innovation have to be established by two separate laws every five years but the last time such laws were adopted in the previous decade. In reality, these priorities have not been revised for years. Instead of two, one Law of Ukraine on the Priorities in Science and Technology Development was passed through Ukraine's parliament in 2012. These priorities include:

- Fundamental research of prominent multi-disciplinary scientific problems;
- Environmental studies;
- Information and communication technologies (ICT);
- Energy generation and energy-saving technologies;
- New advanced materials;
- Life sciences, including methods for fighting leading cause of illness and disease [32].

However, due to several reasons, both objective and subjective, the government initiated a reform of the STI priority system. The key idea is to combine S&T and innovation priorities, which aim at making R&D close to innovations. Meanwhile, there are bottlenecks that might exclude some stakeholders from the policy making process, namely the parliament. In turn, it impedes the development of shared vision.

It is evident that the effective development of S3 strategy and, especially, its corresponding roadmap requires revision of this relatively long list of broadly defined priorities and concentration of limited resources on these newly-defined priorities.

Ukraine had no specific Action Plan for innovation and S&T, although it was drafted in 2011 with assistance of EU experts [33]. The new Strategy related to innovation development was adopted in 2019 by the government. It assumed developing an Action plan that was approved by the government as late as in December 2021.

In 2017, the S&T and innovation policy and existing capacity for the development of S3 strategy for Ukraine have been analyzed according the so-called S3 Assessment Wheel procedure. The detailed assessment has been made by I. Yegorov and Yu. Ryzhkova in *Innovation Policy and Implementation of Smart Specialization in Ukraine* [34]. According to them, Ukraine is far beyond

proper S3 implementation, while the main weaknesses concern monitoring and evaluation, identification of priorities, governance and policy mix. By fact, all weaknesses have been identified during the S3 processes in Ukrainian regions, in 2019—2020.

FIRST STEPS TOWARDS IMPLEMENTING THE S3 PROCESS IN THE REGIONS OF UKRAINE

Officially, the S3 process started in 2016, when the National Academy of Science of Ukraine got an order of the First Vice-Prime Minister to elaborate ways for the S3 implementation in Ukraine. Since that time, the S3-related relations between the NAS of Ukraine, the government, and JRC have been established. In order to facilitate the implementation of smart specialization in Ukraine, the government and the Reform Support Offices of the Ministry of Economy have initiated the involvement of experts from the EC Joint Research Center within the TAIEX (Technical Assistance and Information Exchange) tool. They have developed a methodology for mapping economic capacity and analyzed the regional context in the three pilot regions: Odesa, Kharkiv and Zaporizhia Oblasts [35, 36]. Also, EU experts were involved in knowledge sharing and capacity building in workshops for regional stakeholders (mostly government and expert society) to work on the mapping and S3 priorities. In 2019, all Ukrainian regions started their work on the S3 goals as an integral part of regional strategies for 2021—2027. As S3 was a very novel issue for regional governments, they actively involved experts from research organizations and universities to the S3 development process. The City of Kyiv and Kyiv Oblast were among the leaders in this process. The cases of these regions are interesting as the City of Kyiv is a metropolitan region that is the most economically developed in terms of research base, service sectors, while Kyiv Oblast has a hybrid economy (strong agriculture and diversified industries) that is closely interconnected with the City of Kyiv (labor force, location of some industrial plants, etc.). The Kyiv City Public Administration and the Kyiv Oblast Public Administration worked separately on the S3 and regional strategies.

The S3 methodology assumes permanent actions and continuity, but even first results have helped regional authorities to identify the priority areas for support and to involve the key stakeholders in decision-making process. It is important to mention that the regional development strategies consider the existing capacity of research and higher education institutes an integral part of the TH model. The brief results of one of these projects are presented below.

The City of Kyiv. Unlike other Ukrainian regions, the current strategy for the development of the City of Kyiv will end in 2025, so Kyiv has enough time for developing a new strategy and more chances to utilize smart specialization approach. In 2019, the Kyiv City Public Administration with experts of the Institute for Economics and Forecasting started developing the smart specialization for the city using the guidelines of JRC experts. The regional context, including innovation, scientific, economic, export potentials has been analyzed. In addition to the official statistical data analysis, calculations of critical mass and local quotient, a SWOT analysis of economic activities (NACE 3-digit level) has been made. To validate its results several public events have been organized as a first step of entrepreneur discover process (EDP). First, the special workshop was held in May 2019.[1] The participants represented major stakeholders, including academia, universities, city government, and business. The qualitative analyses have been made, as the questionnaire reflects the 3 types of priorities:

- Business area in the context of impact and potential for development;
- Advance technology area; and
- Societal challenges of the city.

[1] https://www.innopolicy.info/%D0%B7%D0%B0%D1%85%D0%BE%D0%B4%D0%B8/31-5-19, https://dei.kyivcity.gov.ua/content/konferenciya-smartvektory-kyieva.html

The relevance to national priorities was not included, as there are no clear priorities for the next period (2021—2027).

The survey has revealed challenges that are typical for regions with low institutional capacities. They are the lack of trust in public initiatives and poor business representation. Nevertheless, the results of survey have confirmed the results of regional context analysis, and contributed to further development of smart specialization process.

Given a low level of collaboration with business, it has been decided to use soft tools to get their opinion on the future S3 priorities and to identify the most active entrepreneurs for the future EDP process. Thus, the online survey was designed and conducted in Kyiv in 2019. The questions covered the SWOT analysis, future perspectives, cooperation with stakeholders, etc. The number of responses was rather low again. However, it demonstrated the willingness of certain industries to participate in the S3 process.

Aggregating the results of all activities, the directions where the City of Kyiv most probably may find smart specialization are as follows:

- ICT related activities, including software and some machinery production;
- creative industries, like arts, films, and TV show production, advertising; and
- pharmaceutical and health related services.

These directions have been approved by the city government as a base for developing the future City Development Strategy. In 2020—2021, the EDP process was extended.

Kyiv Oblast is a Ukrainian region that is among the top 10 by most economic and innovation indicators in the country. The smart specialization activities are done in the framework of the Regional Development Strategy for 2021—2027. The experts of the Institute for Economics and Forecasting and regional government have developed a strategic goal based on smart specialization concept. The same approach that has been used in Kyiv is applied to the analysis, while pre-EDP stage slightly differs from the Kyiv City case[2]. Several working groups and workshops with stakeholders, including local businesses, representatives of research organizations, universities, local authorities, have been created. Given the results of quantitative analysis and open discussion, the following directions of smart specialization have been identified and put into the draft of Regional Development Strategy for 2021—2027:

- Innovative food products with improved consumption features (functional food);
- Development of energy efficient solutions based on alternative energy sources Innovation products for construction, design, and life; and
- Bioactive compound and pharmaceuticals for health.

In 2021, Kyiv Oblast regional government organized a series of public events for each priority direction.

In the TH context, the City of Kyiv and Kyiv Oblast cases have revealed several problems of the preparation phase, which are related to weak multi-vector links between stakeholders and a low commitment in joint activities in Eastern Europe countries. Both cases have fully confirmed that trust deficit *renders any bottom-up, place-based regional and national policies almost powerless to do anything about* [37].

Thus, it is crucial to extend the preparation phase and to intensify the activities on capacity building of all stakeholders, to develop tools and policy instruments, which may gather stakeholders in “one boat”. It means all stakeholders, es-

[2] https://www.kyivregioneconomy.com/single-post/2019/09/30/%D0%B2-%D0%BA%D0%BE%D0%B4%D0%B0-%D0%BE%D0%B1%D0%B3%D0%BE%D0%B2%D0%BE%D1%80%D0%B8%D0%BB%D0%B8-%D0%BD%D0%B0%D0%BF%D1%80%D1%8F%D0%BC%D0%B8-%D1%80%D0%BE%D0%B7%D0%B2%D0%B8%D1%82%D0%BA%D1%83-%D1%81%D0%BC%D0%B0%D1%80%D1%82-%D1%81%D0%BF%D0%B5%D1%86%D1%96%D0%B0%D0%BB%D1%96%D0%B7%D0%B0%D1%86%D1%96%D1%97-%D1%80%D0%B5%D0%B3%D1%96%D0%BE%D0%BD%D1%83

pecially business, should clearly understand what benefits they can get and legal commitments might be desirable as well. Currently, many of Ukrainian regions continue efforts on S3. The JRC has provided expert support to 8 regions to facilitate EDP,[3] while others work on EDP by their own. One of the biggest challenges is low interest of business to participate in such initiatives. It is common problem for many countries, even in the EU. However, unlike the EU case, Ukraine is not able to stimulate business with special funding, e.g. EU Structural Funds. There have been no specifically designed policy instruments to finance S3 projects yet.

CONCLUSION

New political forces came to power in early 2019 and declared pro-Western foreign policy and liberal reforms within the country. According to the plans of the government, the purpose of the economic reforms is to promote innovation in the economy and to provide better utilization of S&T capacity in order to achieve technological upgrade of national industrial sector and agriculture. This creates favorable preconditions for the development and implementation of S3 strategy in the country. Such strategy might be a key element of Ukraine's catching-up policy. At the same time, there are important internal barriers on the path towards its efficient implementation:

- The legislation has not been harmonized enough;
- The general economic situation is complicated;
- The labor market is not sufficiently flexible. It is still strictly regulated, with the mobility of workforce remaining rather low;
- The regional innovation and industrial policies are underdeveloped;
- The coordination between different agencies and ministries is at the low level.

These barriers may create significant obstacles on the way towards the introduction of S3 concept in the country:

- The country had several innovation plans and strategies in the past, but none of them has been implemented;
- Financial barriers remain the most important obstacle on the innovation path;
- Different measures do not articulate the need to attract both national and foreign financial resources and cooperation between actors. These measures have to include the initiation of the special government programs, the creation of venture funds, strong guarantees for intellectual property rights protection;
- The situation with business climate remains difficult. It is very important to improve it, and to create conditions in which entrepreneurs are willing to sell significant part of their shares to outsiders. Also, they should be willing either to acquire shares or to participate in public offerings.

Proper implementation of the legislative acts remains the weakest part of S&T and innovation policy. The introduction of adequate legal protection for intellectual property rights is of critical importance for individual researchers, S&T institutes, and innovation enterprises. This is also very important for foreign companies seeking to be engaged in direct investment or in some other form of business alliance and for domestic companies that cooperate with them.

The ways of interaction between business, government, education, science, and the public, in the context of setting priorities for smart specialization, should be following:

1) Creating an innovation ecosystem (support for startups, SME); increasing business expenditure on fundamental and applied research;

2) Creating a communication system (business meetings, public dialogue, forums, conferences, seminars, crowdfunding);

3) Public-Private Partnership;

4) Open meetings for business to discuss the main direction of smart specialization for each region;

[3] https://eu.eventscloud.com/file_uploads/e9b483eca5ea75bd25c9ada0b1b6fb5d_MATUSIAKMonikaEaP10Dec2020.pdf

5) Demonstrating strong commitments and policy tools to support the smart specialization priorities.

Some prospects for the further analysis are associated with the implementation of new concepts that include more key players, such as the quantahelix [38] and pentahelix models [39] of innovation development. However, it is difficult to predict whether these models have advantages in Ukraine's situation.

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ЗАБЕЗПЕЧЕННЯ ВЗАЄМОДІЇ «ПОТРІЙНОЇ СПІРАЛІ» ЧЕРЕЗ ВПРОВАДЖЕННЯ СМАРТ-СПЕЦІАЛІЗАЦІЇ: ПРИКЛАД УКРАЇНИ

Вступ. Євроінтеграція обумовлює необхідність коригування інноваційної політики, зокрема й впровадження смарт-спеціалізації (S3). S3 є новим інструментом для сприяння зростанню в регіонах на основі знань.

Проблематика. S3 спрямована на стимулювання нового виду економічної діяльності, що виникає на перетині інтересів широкого кола учасників. Впровадження S3 в Україні розпочалося у 3 пілотних регіонах у 2017 році. Результати цих пілотів не було враховано належним чином при включенні S3 до стратегій регіонального розвитку. Незважаючи на технічну підтримку Європейської комісії, частина регіонів не змогли адаптувати процес вироблення регіональної політики та забезпечити належну взаємодію «потрійної спіралі» (ТН) у процесі запровадження S3.

Мета. Оцінити впровадження S3 в контексті взаємодії стейкхолдерів на основі моделі ТН.

Матеріали й методи. Дослідження ґрунтується на даних, отриманих авторами в ході роботи над розробленням напрямів смарт-спеціалізації в Києві та Київській області, аналізі нормативно-правової бази, а також низці аналітичних матеріалів та наукових статей. Використовуються методи узагальнення експертного висновку, контент-аналіз та статистичний аналіз.

Результати. Оцінено перші кроки впровадження концепції S3 у стратегіях регіонального розвитку, визначено проблеми, які необхідно подолати, щоб успішно скористатися S3 та посилити ТН взаємодію в Україні. Проаналізовано поточну ситуацію з впровадженням S3, що відкриває шлях для оцінки українського інноваційного потенціалу, міжнародних порівнянь та застосування вже наявних інструментів вимірювання прогресу в процесі впровадження смарт-спеціалізації в країні. Наведено досвід з розроблення S3 у Києві та Київській області з акцентом на проблемах із залученням зацікавлених сторін.

Висновки. Визначено ключові бар'єри для впровадження смарт-спеціалізації в Україні, а саме непослідовність законодавства, нерозвинену інноваційну та промислову політику, та запропоновано шляхи їх подолання.

Ключові слова: інноваційна політика, потрійна спіраль, смарт-спеціалізація, стратегія.