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ІННОВАЦІЙНА ПОЛІТИКА ТА ІМПЛЕМЕНТАЦІЯ РОЗУМНОЇ СПЕЦІАЛІЗАЦІЇ В УКРАЇНІ

Підписання Угоди про асоціацію між Україною та Європейським Союзом (ЄС) визначає необхідність наближення національної практики використання інструментів інноваційної політики до європейських. На сьогодні у країнах ЄС особливу увагу приділяють інноваційному розвитку регіонів на основі розумної спеціалізації. Розумна спеціалізація для дослідницьких та інноваційних стратегій (S3) застосовується переважно у країнах та регіонах ЄС та є основною вигодою для регіонів ЄС, що реалізують програми розвитку за рахунок коштів Європейських структурних та інвестиційних фондів (ESIF).

Ключовою особливістю концепції S3 є те, що вона орієнтована на підтримку унікальних галузей або видів економічної діяльності, які мають бути пов'язані зі спеціалізацією регіонів. У ЄС S3 розглядають як новий інструмент підтримки, що сприятиме зростанню знань у розвинених регіонах, а також стимулюванню розвитку менш розвинених регіонів та країн.

Відповідно до рекомендацій Керівництва з розроблення стратегії S3, цей процес відбувається у шість етапів: 1) аналіз регіонального/національного контексту та потенціалу для інновацій; 2) управління; 3) спільне бачення; 4) визначення пріоритетів; 5) політика, дорожні карти та план дій; 6) інтеграція механізмів моніторингу та оцінки. Тож основна мета дослідження – застосування методології формування S3 для розроблення стратегії розумної спеціалізації в Україні. У статті представлено оцінку наукової та інноваційної системи на національному рівні відповідно до зазначених рекомендацій за кожним із шести етапів, виявлено їх сильні та слабкі сторони. Також репрезентовано т.зв. "колесо оцінювання", що дозволяє візуально представити великий обсяг інформації, отриманої в результаті оцінювання можливостей застосування розумної спеціалізації.

У висновках автори значну увагу приділили головним бар'єрам на етапах розроблення стратегії, які необхідно подолати для успішної імплементації розумної спеціалізації в Україні як на національному так і на регіональному рівнях¹.

Ключові слова: інноваційна політика, науково-технічна політика, розумна (смайт) спеціалізація, стратегія розумної спеціалізації, регіональна політика, інноваційна система, інноваційна діяльність, пріоритети розвитку

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INNOVATION POLICY AND IMPLEMENTATION OF SMART SPECIALISATION IN UKRAINE

Association Agreement between Ukraine and the EU determines the need to adjust national practices of the innovation policy-making instruments in line with EU standards and principles. EU policy-makers pay special attention to innovative development of the European regions, pursuing development of smart specialisation strategies (S3). The smart specialisation for research and innovation strategies has been mostly applied at the EU countries and regions and the key requirement for regions implementing operational programmes with the European Structural & Investment Funds (ESIF).

A key concept of S3 is focused on support of unique industries or economic activities, which will be associated with the specialization of certain regions. The European Commission (EC) has introduced S3 approach as a new tool to facilitate knowledge based growth in developed regions as well as less developed regions and countries. The main aim of this article is to apply the methodology of the S3 for preparation of the smart specialization strategy for Ukraine.

According to the RIS 3 Guide, Smart Specialisation Strategies should be designed into six steps: 1) Analysis of the regional/national context and potential for innovation; 2) Governance; 3) Shared Vision; 4) Identification of priorities; 5) Policy mix, roadmaps and action plan; 6) Integration of monitoring and evaluation mechanisms. The article presents assessment of R&I systems of Ukraine with regard to mentioned steps and identifies its strengths and weaknesses. Also the authors present the RIS 3 Assessment Wheel which is built on the basis of the six steps and provides a visualisation of the huge amount of information obtained as a result of the assessment.

In the summary, the authors have evaluated barriers that need to be overcome in order to successfully implement smart specialization on national and regional levels in Ukraine².

Key words: innovation policy, STI policy, smart specialisation, smart specialization strategy, regional policy, innovation system, innovation activity, priorities of development

Introduction. 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. The 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) as an instrument to fight crisis by developing appropriate tools for

² This publication was prepared within the research project "Formulate of smart specialisation in Ukraine" (State registration № 0117U006045).

the creation of conditions and relevant instruments for boosting economic growth in a particular region or country [1]. Methodology of S3 is aimed at stimulating new activities, which emerge from the connections between and integration of the knowledge of entrepreneurs, specialised services, local universities and public research organisations, etc. to explore and open new opportunities.

Problem formulation. Smart specialisation has two key goals: to build capabilities through the exploration of a new domain of opportunities; to drive structural change (modernisation, etc.). This is not a simple task, especially for such countries, like Ukraine. There are two main problems, related to analysis. First, SS deals predominantly with the regions, not the countries. So, it is expected that in Europe more than 120 regions have to formulate and implement their smart specialization strategies in 2016–2020 [2]. On the other hand, some countries also prepare their own strategies. Such approach looks rational, especially for less developed countries outside the EU, as co-ordination of 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 will also require a broad-based policy effort focusing not only on STI policies, but also accompanying them with the upgrading of institutional capacity, structural reforms, and investment in human capital. In addition, beyond economic growth, innovation policies need to meet broader societal challenges. This will determine whether 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 will mean building on research excellence to bring innovative solutions to market, at home, and abroad, and piloting solutions that reflect the diversity societies and territories [3].

Key objective of the paper is to apply methodology of the S3 formation for the preparation of the smart specialization strategy for Ukraine. This will be accompanied with the analysis of the current situation in the innovation system, which could open the way for assessment of Ukrainian innovation potential, international comparisons and utilization of already existing instruments for measurement progress in the implementation of SS. We followed the approach proposed by the EU specialists for assessment of the country's potential for the preparation and implementation of S3 [4]. Smart Specialisation Strategies should be designed into six steps, each of them is assessed with 3 critical factors:

- 1) Analysis of the regional/national context and potential 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 RIS 3 update*) [5].

To some extent, it is similar to SWOT analysis on the political level. 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, experts suggest to develop a RIS 3 Assessment Wheel.

Assessment of Ukrainian R&I 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, economic crisis and political problems in the post-Soviet years had negative impact on R&D and innovation. According to the State Statistical Service of Ukraine, the share of GERD dropped to the record low level of 0,48% in 2014 from more than 1% in the middle of previous decade. Bearing in mind the quick depreciation of the national currency and overall drop of 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 observed in 2016–2017 but the growth was not strong enough even to reach the level of 2013.

The share of internal sources of local non-state investors in R&D had a tendency to grow, while the importance of other sources (state budget and foreign investors) had declined. As to the distribution of expenditures on R&D, business sector plays a leading role (56,4% of total expenditures), followed by the government sector (37,8%) and higher education sector (5,8%). The private non-profit sector does not play important role as an R&D performer (nor a source of funding). The level of R&D expenditures in this sector remains substantially less than 1% of total R&D expenses in the country. In general, it is evident that R&D expenditures in Ukraine (both in absolute and relative terms) are much lower than in most EU countries, especially in the case of business R&D expenditures.

Ukraine has long tradition of collecting data on innovation activities. However, this statistics is focused on industrial sector only. In recent years, State Statistical Service of Ukraine has also started to conduct CIS-type surveys of innovation activities in line with the Eurostat methodology. According to the data from both sources (CIS-type survey and the traditional survey of innovation in industry), there was a decline in innovation activities in the Ukrainian economy. Thus the share of innovative enterprises in industry dropped by more than a fifth in 2012–2015, and expenditures on innovation activities were reduced by more than half during this period (in real terms). Situation has improved slightly since that time, but it still remains complicated [6].

The latest comprehensive "independent" surveys of Ukrainian innovation system were made by groups of international specialists from the World Bank in 2017 [7] and by specialists of the United Nations [8]. They showed that, alt-

though R&D and industrial potentials had been shrinking in the previous twenty five years, Ukraine still had capacities for modernization of its economy. For instance, as publication analysis shows, the country is still a relatively strong player in new materials, space and aeronautics research sectors, especially if compare with some other countries of the region [9].

As to the quality of human capital, Ukraine had inherited a relatively well developed educational system. Now, more than 70% of school graduates enter the universities. However, serious concerns have been raised regarding the quality of education in technical and natural sciences. According to the Round University Ranking, prepared by Thomson Reuters, only one Ukrainian university with specialization in technical and natural sciences was in the first seven hundreds universities of the world in 2016: Kyiv Polytechnic Institute took 636th position. (It is also worth to mention that two universities (from Kyiv and Kharkov) with broad specialization took 560th and 593rd positions in the rating but it is not clear due to progress in what disciplines [10]. To great extent, this is due to the economic crisis and the limited supply of working places for university graduates in industry. Universities have limited interaction with the industry. Since mid-2000s, the share of graduates in natural sciences in total graduates has declined by one third, in technical sciences – by more than one fifth, while in humanities and arts grew by 5% and in social sciences, business and law growth reached 45%. It is not easy to assess the pool of researchers, as the country does not use full time equivalent (FTE) indicators. However, the corresponding number declined by more than 3 times in last 25 years, according to our estimates. Majority of research personnel is concentrated in the state institutes, while, on the other hand, more than 70% of doctorate degree holders are working for the higher education sector.

Public research institutes are main players in R&D. Existing instruments of R&D and innovation support (private foundations, technoparks, business-incubators, and leasing centres) are relatively poorly equipped, personnel are not trained adequately and, most importantly, financial resources for support of innovation activities are scarce. Another problem is that traditional sectors (ferrous metallurgy, coal-mining, energy production, basic chemicals, agriculture) dominate in the national economy. These sectors have a more stable technological base, and they are traditionally less innovative than high and medium tech sectors, which contributed to the overall decline of 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 direction in modernising the national economy and insufficient incentives for developing high tech sectors are among key problems of the country.

Ukraine signed an agreement on association with the EU Horizon-2020 program in March, 2015. This opens the way for more active co-operation with the EU countries in R&D in the near future. However, extra support from the Ukrainian government for promotion of joint research and innovation activities is needed, as well as additional links between Ukrainian research establishments and their EU counterparts to forge partnerships in future projects. Support for capacity –



building measures in research and innovation through different instruments of the corresponding policies could help in this regard, especially in implementation of 3S strategy.

Analysis of regional/national context

The state fiscal system provides the central executive bodies with the bulk of tax revenues, making local authorities heavily dependent on Kyiv. As a result, research and innovation policies are mainly directed from the central ministries, although local authorities also have some tools to exert influence, especially on local universities and research organisations. 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. National Academy of Sciences of Ukraine has six Regional Scientific Centres, each coordinating scientific activities in various disciplines. Ministry of Education and Science too has 19 centres of S&T and economic information in different regions (oblasts) of the country. They could 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 activities. The city has several development programmes, which contain research and innovation 'components'. Key measures of these programmes focus on the modernisation of urban infrastructure. Thanks to the efforts of the programmes, several hundred research and innovation projects were implemented in recent 10 years. Odesa, Lviv, Dnipro, and, especially, Kharkiv and some other large cities too have substantial innovative and industrial potentials.

Ukrainian authorities have proclaimed their commitment to renewal of research and innovation infrastructure. Special state program was prepared in 2008 [11]. However, this program did not receive financing for its implementation. Later, attempts to re-start it were not successful either. Substantial part of research infrastructure has been lost in the period of independence. Many institutes have no financial resources to renew their equipment, thus the rate of its renewal was not higher than 2–3% per year in 1990s – 2010s. The situation started changing slightly in the second half of 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. Because equipment is expensive to replace, 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. On the other hand, Ukraine still has some unique elements of research and experimental infrastructure, which could be used for testing in such areas, as aerodynamics, new materials and so on [12].

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 development. The key



problem in the past was the large number of these programs and their permanent under-financing. Since early 2010s, initiation of new programs has been strictly limited. Some of them are still under execution, including a program on nanotechnologies. But the level of financing remains relatively low, and, as surveys show, international grants are playing a growing role (REF). State Fund for Basic Research of Ukraine distributes grants for research projects in different disciplines. More than 50 different calls, some of them with foreign partners, were announced in 1994–2017. Level of financing of these projects was relatively low. The same is true for the projects, initiated by the Ministry of Science and Education of Ukraine. Average was not higher than several thousand euros per year in 2005–2017 in nominal terms. Companies rarely take part in such competitions, but they are trying to explore opportunities, related to the innovation project support within technoparks, industrial parks or science parks. The bulk of money was invested not in high tech sectors, but in agriculture, food industry, banking sector and some infrastructure projects. Ukraine needs more investment and technology transfer, associated with it, in its industrial sector, especially in manufacturing. According to different surveys of innovation activities, lack of financial resources is the key barrier for innovation. At the same time, it is evident that numerous institutions, which have to facilitate innovation development, are inefficient [13]. 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 and at least medium term loans and to contribute to boost 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 calculations of indicators for the Innovation Union Scoreboard (IUS) in 2016 for the first time [14]. The country possessed a modest place at the very bottom of the list according to the meaning of Innovation Index. The country is performing well below the EU average for nearly all dimensions and indicators with exception of the indicators, related to the level of education.

Governance

In the first two and a half decades of independence, research and innovation policies in Ukraine were mainly directed from the central government, while the role of local authorities to exert influence on S&T and innovation development was limited. President and Cabinet of Ministries are playing central roles in decision-making process, while Parliament determine legal framework for S&T and innovation activities. Within the decentralization reform, which started in 2015, the situation has to be changed in the near future, and country's regions could be more important actors in the formulation and implementation of innovation policy. However, till now local authorities have played a negligible role in S&T and innovation policy. There is no specific governance system for R&D throughout the various regions of Ukraine. According to the proposed changes in the national



legislation, one of the primary responsibilities given to regional authorities involves the formulation and financing of regional R&D and innovation programs, within the limits of regional budgets. Authorities could also create regional financial organisations to provide loans for R&D and innovation projects. In reality, however, local authorities had almost no funding to support R&D and innovation. In recent years, regional shares of total funding for R&D has typically been about 1%, and in 2015, these expenditures dropped to lower than 0,3% of total R&D expenditures. The total annual research budgets of regional authorities were less than €2m, according to official exchange rate in 2015–2017. However, in some regions, development programs have sectoral dimension. These regions typically influence R&D through indirect measures, such as provision of land or upgrading of infrastructure. This opens the way for development of regional strategies within the national 3S strategy.

In order to resolve a number of problems in S&T and innovation the Ministry of Education and Science of Ukraine (MESU) along with other ministries, state academies of sciences and non-governmental organizations has substantially modified the Law of Ukraine "On scientific and scientific-technical activity", which passed through Ukrainian Parliament at the end of 2015.

The new version of the Law contains a number of amendments [15], if compare with the previous one. It reinforced an institutional support of S&T activities and opened the way for transformation of the whole national research system. The Law establishes the National Council of Ukraine on Science and Technology Development under the control of the Cabinet of Ministers of Ukraine. The main task of the Council is to ensure the effective cooperation of representatives of the scientific community, state agencies and business sector in the preparation and implementation of state policy in the sphere of S&T. Another novelty is a creation of the National Fund for Research instead of the State Fund for Basic Research, which was subordinated to the MESU. Fund's key function is to provide grant support for basic and applied research in natural sciences, engineering disciplines, humanities and social sciences. Fund can also support experimental development and even innovation projects in S&T priority areas. New Law has to play an important role in the process of transformation of the state academies of sciences of Ukraine, especially the National Academy of Sciences of Ukraine. The Law has opened the way for involvement of ordinary scientists to elections of governing bodies of the academies; it has also established constraints on possession of highest positions in academies and on the number of members and corresponding members of the academies. On the other hand, according to the Law, research institutions from the state sector have received the right to be co-founders of commercial companies and to take part in the formation of their share capital.

The country has started to implement key elements of e-government strategy in recent years. However, it is too early to assess its outcomes. Probably, the most visible result is the implementation of electronic system for public procurement procedures in 2016 [16].

Formally, government has created special advisory groups from representatives of business sector, NGOs, research institutes and officials to co-ordinate reforms in different spheres, including innovation and industry. There are also plans to establish special Department of Industrial Policy within the Ministry of Economic Development and Trade later this year. This Department would coordinate efforts of business groups and the government in modernization of national industry. However, it is difficult to predict at the moment, how successful this co-ordination will be. Another initiative is creation of special High-Tech Office within the Government to stimulate high tech industries, first of all, ICT sector. Business associations along with experts from the government are actively involved in preparations of the legal documents, related to the establishment of the Office. On the other hand, procedures for taking different opinions into account are not well-defined. This opens the way for ignorance of some important initiatives from the side of non-government actors of the decision-making process.

Shared vision

Ukrainian state organisations follow definition of innovation, proposed by the OECD in Oslo Manual [17]. It includes not only technological but also marketing and organizational innovations. It is possible to expect that new forms of innovations will be included into revised version of Oslo Manual in 2019. There are no barriers for inclusion of these types of innovation into official documents in Ukraine. It is possible to expect that all changes will be made in corresponding legislation without problems.

On the other hand, as it was mentioned above, Ukraine is going through a very difficult period of transformation. Thus, social innovations in different areas are urgently important for success of reforms. In principle, Ukrainian society is ready for serious changes but clear perspectives of implementation of such innovations have to be showed, and instruments of reforms, aimed at transformation in social and economic spheres, have to be defined. The country is lagging behind its neighbours in energy-saving, implementation of environmentally-friendly technologies and so on. There is common understanding of the need of restructuring of national economy on the ground of utilization of intensive factors of development.

President of Ukraine has announced his plans of reforms "Strategy-2020" in 2015 [18]. It includes a number of different goals. The plan assumes that the GDP per capita will grow to 16,000 USD (in PPP), Ukraine will enter 20 top countries according to the doing business conditions, 40 top states according to the Index of Competitiveness and so on [19]. In fact, there is consensus in the Ukrainian society that these goals are important for the country. The first steps in terms of changes in the legislative sphere have been already made. This Strategy does not mention S3 directly but some positions correspond with the key principles of smart specialization. At the same time, level of co-ordination between executive power, legislative bodies and some key business groups remains low. Substantial part of business is not actively involved in preparation of legal docu-



ments, related to S&T and innovation. This could create problems at the stage of implementation of proposed measures.

Identification of priorities

S&T and innovation were not mentioned directly in the Presidential Strategy of Reforms. However, innovation is determined as the key instrument of economic transformation and element of growth of competitiveness. Key idea of the Presidential Strategy is to provide further integration of Ukraine into European economic and legal space, growth of co-operation between Ukraine and the EU.

According to the legislation, priorities of S&T and innovation have to be established by two separate state laws every five years but the last such laws were passed in the previous decade. But in reality, these priorities have not been revised for years. Instead of two, one State Law of Ukraine "On Priorities in Science and Technology Development" was passed through the Parliament in 2012. These priorities include:

- Basic research of prominent multi-disciplinary scientific problems;
- Environmental studies;
- Information and communication technologies (ICT);
- Energy generation and energy-saving technologies;
- New materials;
- Life sciences, including methods of fighting leading cause of illness and disease [20].

Unfortunately, no data exist on the corresponding shares of the total GBAORD allocated to such research priorities. In any case, it is evident that effective development of 3S strategy and, especially, its corresponding roadmap will require revision of this relatively long list of broadly defined priorities and concentration of limited resources on these newly-defined priorities.

In fact, priorities in innovation and S&T were established without proper co-ordination with general priorities of social and economic development of Ukraine. They were formulated on the base of propositions of different actors without proper analysis of corresponding potential in specific areas.

Only in some sectors, such as biotechnologies, ICT and energy technologies special foresight-type studies were conducted in early 2010s at the national level. Corrections have to be made to make priorities better grounded and more 'operational'. On the base of these newly-formulated priorities specific programs have to be prepared in co-ordination with the industry.

Policy mix

Ukraine has no specific Action Plan for innovation and S&T, despite a draft of such plan was prepared in 2011 with assistance of EU experts [21].

In the years of independence, more than 80 different legislative acts, were passed through Parliament or issued by the Ukrainian government in 1990s and

2000s. Activities were continued in 2014–2015. A number of other key legislative acts in the sphere of S&T and innovation, such as laws on "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 are under revision. However, proper implementation of legislative acts remains the weakest part of S&T and innovation policy. Introduction of adequate legal protection for intellectual property rights is of critical importance for individual researchers, S&T institutes and innovative enterprises. This is also very important for foreign companies seeking to engage in direct investment or some other form of business alliance, and for domestic companies that co-operate with them. Content of new versions of the above-mentioned laws has to be modified according to the goals of the main positions of the 3S strategy.

Currently, the Ministry of Education and Science supervises the activity of the higher education sector and to some extent, institutes of six state-owned academies of sciences. The largest one of them, the National Academy of Sciences of Ukraine traditionally acts as a very important player in the national research system; it receives approximately half of the total government's R&D budget. Academies are responsible for basic research, but they also have coordinating functions in many R&D and innovation-related programs, participate in establishing S&T priorities and provide scientific advice to the government.

Ministries exert influence on sectoral R&D and innovation policies through various branch institutes under their supervision. Traditionally, branch institutes have had strong ties with such enterprises, and conducted a great deal of research that was in the interest of the companies. In recent years, the importance of these institutes has declined, and the control over their activities from the side of the Ministries has weakened. Some research institutes are connected with the relatively new research and innovation organisations, which have emerged in two recent decades – technoparks, technology transfer centres, and so on. Implementation of 3S strategy will require changes in the whole system of management of these organizations.

In general, horizontal and vertical measures of industrial, innovation and S&T policies are not co-ordinated well in Ukraine. If horizontal public inputs, such as provision of education, lowering costs of starting up business and some others are at the satisfactory level, market horizontal inputs (R&D tax credit, training subsidies other financial measures) are not working in Ukraine. Similar situation is with vertical inputs. Ukrainian government provides thematic funding for some R&D, it supports technological consortia and creation of new forms of industrial activities and so on. Promotion of vertical market inputs measures, including support of specific sectors (defence, first of all), public procurement and other similar instruments have been less developed in recent years. However, the main problem was in poor coherence in the implementation of corresponding instruments. To find balance between different measures, it would be rational to try to introduce some of them in an experimental form.



Monitoring & evaluation

Since 2016, monitoring and evaluation in S&T and innovation on the national level could be made on the base of indicators of Innovation Union Scoreboard and with the assistance of "traditional" statistical indicators.

Now, two types of evaluations are used in the public sector. The first one is based on the evaluation of activities of the state research organisations. This evaluation includes qualitative assessment and some selected indicators (number of research papers, patents, participation in international conferences and so on) of the research activities of the institute. Recently, National Academy of Sciences has started to use approach, which is based on experience of German Leibnitz Association. The second type of evaluation is associated with the assessment of research projects and programmes implemented by research institutes.

The evaluation of project implementation is usually made by a commission, which is formed by the corresponding Ministry at least once per year, and at the end of the project. If the project has identified "key performance indicators", then the project results are compared to these indicators. However, very often the objectives of innovation projects are not defined in sufficient detail. In addition, very few projects have sufficient budget to reach their proclaimed objectives. This is frequently cited as the reason why project results are inadequate.

The State Auditing Chamber, a division subordinate to Parliament, examines the activities of different ministries and state-sponsored academies of sciences approximately once every two years. Auditors typically focus on the relevance of R&D expenditures compared with the announced goals, and also fix violations of existing legislative acts. Parliament of Ukraine arranges regular hearings on problems of S&T and innovation development. However, the system of evaluation has to be modified to meet standards, which are used in the EU countries. Monitoring and evaluation have to be oriented more on the output indicators. These indicators reflect outcome of corresponding policy measures and overall results of S3. It is important for gaining higher efficiency of project implementation and transparency of selection procedures.

Summary

As a result of analysis of S&T and innovation policy and existing potential for development of S3 strategy for Ukraine, it is possible to make an assessment according to the so-called S3 Assessment Wheel procedure.

The RIS3 Assessment Wheel was built on the basis of the six steps which are discussed above in this paper and the identification of three critical factors for each of the steps. The scaling tool (from 0 to 5) estimates the seriousness of the evidence provided in the process as far as each critical factor is concerned with the following meaning: 0 = no information available on the specific element; 1 = poor; 2 = to be improved; 3 = fair; 4 = strong; 5 = excellent [5].

The results, which are presented below, were received in 2017 by the group of Ukrainian and international experts during the special "exercise" in the EU

Joint Research Centre (JRC), Seville, Spain. Generalization of the results was made by the experienced moderators from the EU countries. It is evident from the Figure 1, that Ukraine received modest marks on all positions (not higher than mark 3).

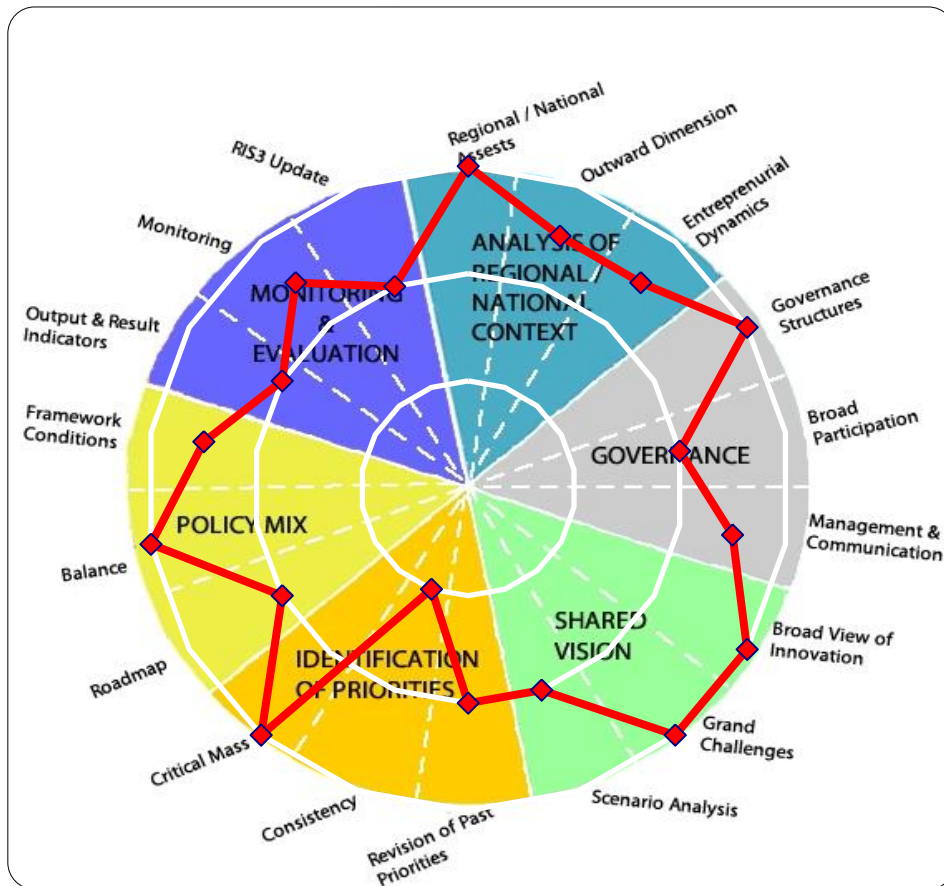


Figure 1. RIS 3 Assessment Wheel of Ukraine

Source: authors' construction in cooperation with JRC experts.

It is worth to mention that these assessments are made on the base of analysis of recent events, publications and communication with experts from academia and the government, involved in implementation of innovation policy. However, presented marks are preliminary, and they have to be corrected in the future, when survey of proposed indicators with broader participation of specialists from different areas will be conducted.

National context – Main developments and barriers:

New political forces came to power in early 2014 and they declared pro-Western orientation of the foreign policy and liberal reforms within the country. According to the plans of the government, the purpose of economic reforms is to



promote innovation in the economy, and to provide better utilization of S&T potential in order to achieve technological upgrading of national industrial sector and agriculture. This creates favorable preconditions for development and implementation of 3S strategy in the country. Such strategy could be a key element of the country's catching-up policy. At the same time, there are important internal barriers to its implementation:

- Legislation is not harmonized enough.
- General economic situation is complicated.
- Labour market is not sufficiently flexible. It is still strictly regulated and mobility of workforce remains low.
- Regional innovation and industrial policies are underdeveloped.

These barriers could create main obstacles on the way of introduction of 3S concept in the country.

Governance – Main developments and barriers:

Ukrainian government makes serious efforts, aimed at harmonization of legislative acts and their enforcement. A number of laws and regulatory acts in the area of S&T and innovation have been revised or are under revision. Functions on management of R&D and innovation sphere are distributed between different ministries and agencies better, than in the past. However, important barriers exist:

- Lack of cooperation between different actors of innovation system remains a serious problem.
- Ukrainian state is not very active in promotion of such co-operation between key internal and external actors, including EU partners.
- Low involvement of Ukrainian companies into joint scientific and innovation projects.
- R&D 'assets' are viewed largely as a liability. This is partly the result of structural and organisational mismatches, and partly because of their low immediate relevance to the realities of market economy.

Shared vision – Main developments and barriers:

There is a broad consensus in Ukrainian society about importance of innovation. Policy documents show that innovation is considered as a key factor of modernisation of the country. Thus, implementation of broader concept of innovation will not be rejected by Ukrainian scientific community, business or the government.

However,

- There are still differences between main actors on the mechanisms of promotion of innovation and R&D.
- Part of the government, notably, Ministry of Finances, is not ready to introduce supportive measures for innovation.

- Two other ministries – the Ministry of Economy and the Ministry of Education and Science – could not agree some positions in the new version of the Law on Innovation.
- Business sector is not actively involved in discussions on the innovation issues.

This creates certain problems but they could be solved if all parties will demonstrate their intention to compromise.

Identification of priorities – Main developments and barriers:

Ukraine has several laws that are aimed at establishment of priorities in S&T and innovation. At the same time,

- In fact, in recent years these laws have not been implemented in a proper way.
- Other problems are related to very broad definitions of priorities and lack of financial resources for implementation of corresponding government programs. It is important to focus on specific areas, which have high potential for development.
- Co-ordination between innovation and industrial policies in priority settings at the state and regional levels remains poor.

Policy mix – Main developments and barriers:

The country had several innovation plans and strategies in the past. Not any of them has been implemented.

- Financial barriers remain the most important obstacle on the way of innovation.
- Different measures do not articulate the need to attract both national and foreign financial resources. These measures have to include initiation of the special state programs, creation of venture funds, strong guarantees for intellectual property rights protection.
- Situation with business climate remains difficult. It is very important to improve it, and to create conditions, where entrepreneurs will be willing to sell significant part of their shares to outsiders and also they will be willing either to be acquired or to participate in public offerings.

New Innovation Plan (or Strategy) could be developed with the assistance of the EU experts.

Monitoring and evaluation – Main developments and barriers:

Ukraine has some positive experience in evaluation and monitoring. The country has started to use results of the Innovation Scoreboard and other instruments, developed within the EU, for formulation and implementation and evaluation of



national innovation policy in 2015–2016. It would be also useful to prepare an annual state report on the situation in S&T and innovation in the country.

- But comprehensive system of monitoring and evaluation in S&T and innovation in Ukraine has not been created, despite there is a special state law on evaluation in S&T in Ukraine.
- Key problem of evaluation at the middle level are non-transparent procedures and use of 'administrative resources' for obtaining required results.
- Evaluation is not focused on output indicators, while resource indicators are playing key role in decision-making processes.

It is evident that the implementation of 3S concept in Ukraine will face a number of barriers but the country has to find its place in the quickly changing world. The right selection of future specializations, based on existing potential, is critically important for its development.

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