The mechanisms of integration in conditions of asymmetry of innovative development of the EU

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Abstract

The article concerns to methodological and applied aspects of integration mechanisms functioning in the field of innovation activity of the EU countries. Evolution of models of innovative processes and the detailed forms of integration in their section were investigated. The innovative strategies of EU member states in the context of integration and their effectiveness were analysed. The attention is focused on the transfer of knowledge as the main resource of international cooperation. The advantages of a common innovation environment for participants were considered. The experience of innovative development of the leaders of the countries was highlighted. Requirements for companies planning to innovate or implement innovative projects were disclosed. Preliminary recommendations for eliminating asymmetry in EU innovation development were formulated.

Keywords: integration, innovation activity, transfer of knowledge, innovation policy, project

Introduction

The innovation process is complex and multifaceted. Typical processes that form an innovation project have their own specifics since there are differences in the team's professional level, the value of attracted capital, the list and nature of risks etc.

The environment of innovative projects is integrated into the global space, from where the project draws knowledge, technology, resources and where the finished innovative product, intended for commercialization, is delivered.

A vivid example of multilateral integration is the European Research Area, which started its formation and development since 2000, and is based on the movement of goods, services, people, researchers, knowledge and technology.

One of the flagship initiatives of the development strategy of the European Union "Europe 2020" was defined as the "Innovation Union" providing for reorientation of research and innovation policy towards major challenges, namely climate change, energy efficiency, resource efficiency, health, and demographic change.

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The disparity of contributions to the innovative development of the EU Member States creates new requirements to rationalize the use of available resources. Different level of economic development of member states creates risks of innovation asymmetries that occur through the inconsistencies of national innovation policies and ineffective mechanism to promote the innovative entrepreneurship.

The aim of this study is to develop an integrated approach to the implementation of innovative projects implemented in the EU, namely to perform the following tasks:

- to identify the features of implementation of innovation strategies in the EU member states;
- to formulate the requirements for companies planning to engage in innovative activity or to implement the innovative projects;
- to identify the forms of integration within the framework of innovation process models;
- to analyse the key indicators, characterizing the level of innovative activity development in the EU member states;
- to develop recommendations for elimination of asymmetries in innovative development of the EU.

Theoretical and methodological basis of this research was created by the works of J. Cantwell, H. Chesbrough, E. Coukos-Semmel, K. McDonald, R. Rothwell, K. Schwartz, A.Torre *et al*. who investigated the integration aspects of innovation processes and their driving forces.

A retrospective analysis of views on implementation of innovative projects will enable to identify the key factors having a significant impact on the innovative development of national economies. Knowledge and education are significant factors forming the basis for development and capable of serving as a subject of international integration projects. Giannetto and Wheeler (2000, p. 49) believe that the knowledge management is an opportunity to maintain a leading position in a highly competitive business environment, since in modern conditions the winner is the one who knows how to work faster and more efficiently, i.e. who possesses and manages knowledge.

In this respect, the EU experience in developing and implementing the framework programs designed to stimulate innovative processes in recipient countries, with an emphasis on priority areas, is noteworthy.

A special attention will be paid to the proper analysis of models based on Hidden Knowledge and Quick Learning, Open Innovation, Extended Innovation network and Collaborative Innovation Network, since various integration communications are clearly traced in the context of these models.

The proper analysis is supplemented with analytical material, revealing the performance of innovation processes in the EU member states and non-EU members for comparative analysis. The

background information for analysis was obtained from Eurostat, The Trend Chart on Innovation in Europe, The European Innovation Scoreboad, The Innonarometer etc.

Using the analysis of various indicators, we can synthesize certain conclusions giving an insight on effectiveness of the EU innovation policy in general and the criteria for propensity to integration as the most important aspect of optimization and improvement of the invested capital efficiency.

1. Evolution of Innovative Process Models

The organization of innovative processes in the global space is subject to qualitative changes dictated both by the needs to share the experience and information, and by attracting resources from the outside. It is important that the innovative process included not only original ideas, the development of new technology and obtaining of a new product. The diffusion of innovation into the other sectors, development of new market segments, adaptation of new products and technologies for other areas are also very important (Ilyenkova, S., Gokhberg, L. and Yagudin, S. 2003, pp. 21-22, 27-29).

In his study, A. Torre indicates that at the international level, the process of globalisation plays a significant role in promoting and determining the consequent trade policies. At the domestic level, the policy-making is very well allied with the autonomy of state agencies, as well as their institutional capacity and strength. Given that no country or state produces everything it requires single-handedly, the international business appears to be not only a venue where the countries get the services and goods not available to them or lacking in adequate amounts, but also is a participant of international politics either to realize, encourage or maintain peace among global trading partners or nations, or a source of the countrywide insecurity resulting from external advancements in nations which it depends or inter-depends on for crucial merchandises. Occasionally, the battles are fought to preserve that security of the nation (Torre, 2008, pp.869-889).

Continuing Torre's idea, we should note the importance of integration processes to implement the innovative projects. Because of their complexity and uniqueness, the project team has to resort to attracting intellectual assistance and resources from outside. Integration is not a static value. The forms of its manifestation periodically undergo changes.

While the supporters of early neo-liberalism, M. Allais and W. Ropke, considered full integration to be a single market space with market-independent market forces, the supporters of late neoliberalism (B. Balassa *et al*.) paid special attention to the evolution of integration based on the development of economic and political processes in the country. The followers of corporatism (W. Rostow, S. Hymer) assigned the leading role to international corporations in international economy

integration. In turn, the structuralists (G. Myrdal *et al*.) believe that large firms and industries directly involved in the transformation of national economies are the main centres of integration.

J. Cantwell wrote about the leadership of technology and the role of globalization in the innovation transfer process in 1997. His work has not lost its relevance until now. The researcher believes that technology leaders have altered the nature of international technology creation by pioneering the international integration of MNC facilities into the regional or global networks. Globalization in this sense involves the establishment of new international structures for technology creation. In the past, foreign technological activity exploited domestic strengths abroad, where it was located in response to the local demand, assisted the growth of the other high-income areas, and its role ranged from the adaptation of products to suit the local tastes through to the establishment of new local industries. At that time, the capacity to implement the internationally dispersed innovations was derived from a position of technological strength in the firm's home country base, and led to similar lines of technological development being established abroad. By contrast, today, for companies of the leading centres, foreign technological activity now is increasingly aimed at tapping into the local fields of expertise, and at providing a further source of new technology, which can be utilized internationally in the other MNC operations. In this respect, innovation in the leading MNCs is now more genuinely international or, according to the language of this paper, it has become 'globalized' (Cantwell 1997, p. 236).

The integration took a step beyond the boundaries of corporations and focused on the level of economic alliances. Here the integration processes are subordinated to a common policy and strategy, and innovation activity is planned and linked to various sources of financing. Both the representatives of the dirigisme and the neo-Keynesians insisted on the coordination of internal and external policies of the integration participants. Now we can observe these theoretical developments in action.

The way to innovation and competitive production runs through the main components of innovation policy, which is a guideline for state and business ideology. The politics is a dynamic component accompanying the development of national innovation systems and adjusting their settings.

Policy development and innovation is derived from the development policy of the other areas. While the development policy arose primarily from SME policies, the innovation policy arose from the policy of development, science, technology, research and designs (Dahlstrand and Stevenson, 2010, p. 2).

The integration approach, as a reflection of the ideas of integration policies of economic, political and business entities, found its expression and developed many forms within the framework

of innovative projects. It is related both to the interaction of participants who represent various jurisdictions and institutions, and integration of the processes and programs within the framework of projects.

V. Kulichenko (2016) in his study notes that this approach makes it possible to provide a synergistic interaction of all elements of projects and programs, which in turn leads to increased control over budgetary expenditures, reduces corruption, improves the budget planning justification, early risk detection and risk management, increasing the transparency and efficiency of management.

McDonald, Tuselmann, and Heise (2002) noted that MNCs focus on supplying all or large parts of Europe from fewer sites and on creation of new markets. However, there is evidence to suggest that European subsidiaries of MNCs based in large European economies such as Germany, France and UK tend to grant lower-level mandates to their subsidiaries than is the case of non- European MNCs and those based in the smaller economies of Europe. Granting the low-level mandates to subsidiaries in regions does not offer a broad range of desirable assets in understandable form, but it is not clear why there should be a country-specific effect based on the home base of MNC. The authors provide theoretical explanation of the low-level subsidiary development in regions with few desirable resources and believe that involvement in international business undertakings helps nations optimise their country's proficiency in trade in delivery of services and goods to the international market, promoting the emergence of new ideas in business.

All these trends are reflected in the quality of innovative projects. Rothwell (1993) identified five models of innovation processes. An evolution has led to the emergence of new models of innovation processes, and this trend continues (annex 1).

In these models, we have identified the forms of integration. So the evolution is considered from the standpoint of cooperation form development. If the first-generation model does not include integration relations, the transformation within the organization views on innovation began to form links between R&D and operating units, as well as marketing and R&D. In addition to the state policy at all levels, the market intervenes in the integration process. It performs the functions of selecting participants and integrating their efforts to create the competitive value-added products, works, and services.

The automatic transformation of knowledge into new products is replaced by a conscious process of creating an innovation oriented to the market. Marketing-oriented approach is developing in cooperation with suppliers and leading customers. Any customer's desire is reflected in improvement of the relations with suppliers. Strategic partnership and joint research projects lead to

the formation of the "open innovation" concept. A consistent approach to creating innovation is replaced by a process approach.

The concept of open innovation activates the cooperation of enterprises and organizations in the field of research, development and commercialization of innovations. Thus there is a risk of loss of the advantages obtained as a result of joint innovative activity.

Chesbrough and Schwartz (2007) believe that the "open innovation" model attracts external participants and sources to help them achieve and support innovation.

Laursen and Salter (2006, p. 146) believe that a central part of the innovation process in about the way the firms search for new ideas having a commercial potential. New models of innovation have suggested that many innovative firms have changed the way they search for new ideas, adopting open search strategies involving the use of a broad range of external actors and sources to help them achieve and sustain innovation. The main idea formulated by researchers is that “We introduced two new concepts, i.e. external search breadth and external search depth, to describe the nature of a firm’s strategies to access knowledge from sources outside of the firm. We have argued that firms which are more open to external sources or search channels are more likely to reach a higher level of innovative performance. Openness to external sources allows firms to draw in ideas from outsiders to deepen the pool of technological opportunities available to them.”

Introduction of the concepts of external search breadth and external search depth allowed specifying the strategies of enterprises in terms of openness to innovation, to provide them with quantitative characteristics in order to evaluate the effectiveness in the future.

The creation of innovation, international research and collaborative innovation network expanded the forms of cooperation. Joint innovative programs are constructed on the basis of business processes of participants, involving the ready modules created by partners in the implementation process. Smart procurement, collaborative innovation projects, smart direct investments, joint ventures, and strategic innovation partnerships became universal tools in the field of innovation.

Enkel, Gassmann, and Chesbrough (2009) identify three core processes, which can be differentiated in open innovation:

(1) The outside-in process, which involves enhancing and extending an enterprise’s own knowledge base through the integration of suppliers, customers, and external knowledge sources.
(2) The inside-out process, which refers to securing the commercial/revenue benefits by bringing ideas to the market faster than by internal development via IP licensing and/or multiplying technology, joint ventures, and spin-offs.

(3) The coupled process, which combines co-creation with partners through alliances, cooperation, and reciprocal joint ventures with the outside-in process (to gain external knowledge) and the inside-out process (to bring ideas to the market).

Dedicated processes, forming the basis of integration, create its new forms and facilitate the development of the most acceptable options for cooperation. Regardless of the process configuration in both open innovations and other models of innovation processes, their basis is knowledge that takes the form of the commodity.

Researchers started operating the –'just in time knowledge' concept (Nonaka, 2003). Possessing knowledge is the driving force of the innovation process and hence the competitive advantage which the company can gain in domestic and foreign markets. So, the innovation process model based on knowledge is being formed.

In order to implement the acquired knowledge effectively, the company must have certain characteristics (Dyer and Singh, 1998, p. 667).

- Absorptive capability, that is the ability to learn and assimilate knowledge from external sources;
- Multiplicative Capability, that is the use of knowledge outside the company is associated with the company's ability to multiply and transfer its knowledge to the external environment;
- Relational Capacity that is the ability to create long-term partnerships.

Relational Capacity enables the company to participate in integration formations generating the basis of international research space nowadays. The productive relationships with partners contribute to increase in the innovation component in the final product and generate a competitiveness.

Ju, Li, and Lee (2006) argued that in order to get competitive advantage, the organizations should continuously learn from outside sources. Through the proper knowledge distribution and sharing, organizations can bring the innovation. So, the organizations must develop such channels within the organizations through which the employees share their knowledge with one another.

Lundvall (2006, p.1) noted that **"**the most fundamental resource in the modern economy is knowledge and, accordingly, the most important process is learning**."** The information exchanged involves change of the knowledge base by interacting parties. This process is described as "interactive learning". Interactive learning involves the learning of the substance (technical learning), communication (communicative learning) and proper behaviour (social learning) (Lundwall, 1993).

The exchange of knowledge and information is only possible in various forms of integration. In the context of project management, integration includes the characteristics, such as combination,

consolidation, communications and integrative actions, which are key to the controlled execution of the project by performing work, successful management of stakeholders' expectations and meeting the requirements. The project integration management involves making decisions about the allocation of resources, finding compromises between competing objectives and alternatives, and managing interdependencies among the areas of project management knowledge (Project Management Institute, 2013).

Collaborative innovation can be considered the highest form of innovation integration, when there are no boundaries, and no legal accountability for performers. Experts are involved in such projects from all over the world. The use of versatile innovation potential in a joint project provides an opportunity to achieve the specified parameters within the scheduled time and with significant saving of resources.

Not having regard to the evolution of models of innovative processes, it is possible to mark them general aim: forming of competition economic grouping on the basis of optimization of charges, use of general base of knowledge and infrastructure.

This purpose setting at the enterprise level provides an opportunity to highlight the key factors for the effective innovation activity of the enterprises and organizations: targeting the needs of potential customers, accessing sources of information and resources (financial, labor). The business processes designing on the basis of integration with other participants of innovation activity enables to optimize the costs of research, production, marketing. The balance of interests of partners within the framework of an innovation project can be achieved by substantiating the forms of such cooperation (joint venture, licensing agreements, franchise, subcontract, joint production, etc.).

2. EU Innovative Development

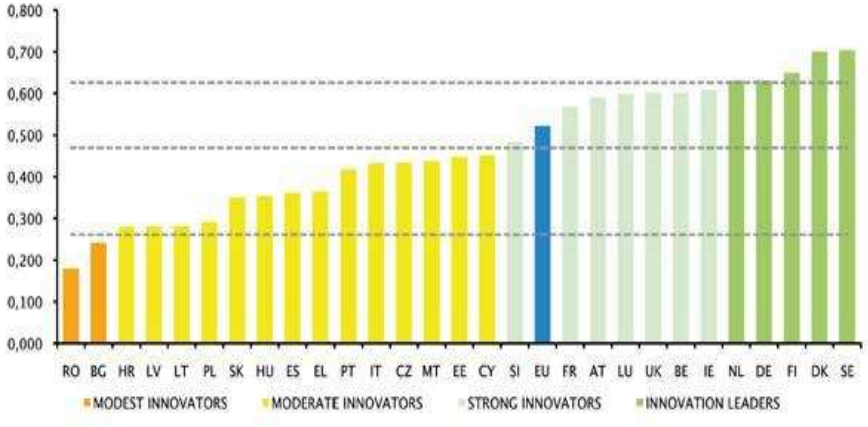
We noted that innovative policies at various levels are a kind of a roadmap for the implementation of innovative projects. Its targets and ways of manifestation depend on the fact whose interests it represents and how they are related to the interests of the agents involved in innovation process. There are the following methodological approaches to the formation of integration structures designed to manage the innovation processes at the national and international levels (Sapelkin and Ivanova, 2012):

- The first one envisages the creation of specialized international organizations intended to coordinate the activities of national innovation actors and innovative infrastructure;

- The second one is the creation of supranational interstate management bodies ensuring the common approaches of the member states of integration entities to the regulatory legal framework, program and information support;
- The third one focuses on the need to unite the existing resources (assets) of economic entities and innovation infrastructure, in order to create the transnational associations (corporations, consortia, holdings) on their basis.

Our study is limited to the second level, i.e. integration entity, which is the EU. Knowledge is a powerful intellectual asset of the EU, promoting the development of industries of different regional command. Regional establishments are not equal. The asymmetry in the levels of innovation potential affects both the overall EU innovation strategy and similar programme documents of the member states.

Figure 1. Innovation performance in Europe *(Innovation Index)*



Source: European Innovation Scoreboard 2016

Figure 1 presents the EU Innovation Index for 2016. The leader is Sweden. Denmark, Finland, Germany and the Netherlands are catching up with the leader. Fast-growing innovators are Latvia, Malta, the Netherlands and the United Kingdom. As follows from the report, the driving force of innovation development for the leaders is formation of a balanced innovation system combining the public and private investment, based on partnerships between science and business and developing on the basis of effective education programs. The leaders of innovation demonstrated openness to cooperation with other countries.

In 2014, a new model was developed in Sweden to prioritize, finance and organize the national and international research infrastructure. The major changes are as follows (The Swedish Research Council, 2014):

- Cyclic process, i.e. prioritization of the infrastructure should be achieved through a recurring cyclical process beginning with the development of the Infrastructure Research Council Guide, followed by decisions on financing of a new or existing infrastructure.
- The use of the Guide to the Swedish Infrastructure Research Council, which is an important tool ro determine the priorities of infrastructure, which is implemented on the basis of stakeholders' needs.
- Joint applications from institutions. An application for participation in the development of infrastructure is made by several universities or organizations.

The Swedish Research Council has drafted a proposal for a long-term strategy for European Spallation Source (ESS) in Sweden. In order for Sweden to benefit from hosting one of the largest research facilities in Europe, the government has tasked the Swedish Research Council with stimulating Swedish participation, usage and expertise development related the construction and operation of ESS.

Within the framework of this government assignment, the Research Council has proposed a strategy for ESS in Sweden. The proposed strategy is long-term and extends to 2030, by which time the facility will have been fully operational for several years. The objective is to increase the return on the Swedish investments and ensure that Sweden and Swedish research obtains the maximum possible benefit from the facility being built in the country. ESS in Sweden shall be a world-leading knowledge centre for the sustainable materials of the future (The Swedish Research Council, 2016).

Sweden research network is a vivid example of collaborative innovation model that enables participants to combine their efforts by sharing appropriate infrastructure, knowledge base, to attract leading experts and use the funds of different origins efficient.

Annex 2 provides strategic integration directions in individual EU countries, the EU as a whole, and Switzerland, which is not a part of the alliance, however, holding the leading position in innovation Europe. The main strategic motto in EU is the progressive integration of companies, especially small and medium enterprises, in the global production and marketing chains and provision og funding based on the framework conditions.

The focus is on the world's leaders of innovative development, which is now Switzerland. Switzerland R&D area shows a high level of internationalization of human resources, manifested in international academic mobility. It supports collaborative projects between businesses and universities. The innovative partners are SMEs, academic institutions etc.

It was noted above that Latvia belongs to the fastest growing leaders. Therefore, we also focused on its strategy. Since 2009, it has embarked on supporting cooperation between unrelated businesses,

research and academic institutions. If we analysed the research and development expenditures in the GDP, we would see that their value is close to 1%. However, its possible to watch a planned capacity of these costs, which is the evidence of substantial financial support of the state innovation development strategy. Orientation for cooperation can be seen in strategic areas of the other countries given in the Table 2.

Europe 2020 strategy envisages increase of the share of expenditures on R&D in GDP to 3%. According to 2014 performance, these requirements were met only by Finland, Sweden and Denmark. In the EU, the average rate is 2.03%, lagging behind the leaders' performance (Table 1).

In Finland and Sweden, the figure is consistently higher, i.e. 3%, over the period examined. Denmark, Austria and Germany are gradually increasing the share of their expenditure for R&D in GDP. The UK share of expenditure remains stable over decades and does not exceed 1.7%. In this country, the scope of R&D was developed following a somewhat different scenario. Since 2008, the percentage of business R&D financed from overseas has remained above 20%. In terms of the absolute GDP value of the country, it was USD 2.8 trillion in 2015, which is much higher than in the other EU countries, and therefore the relative importance of expenditures on R&D in GDP will be slightly different. However, this does not diminish the role of the UK in the development of innovative activities.

Table 1. Research and development expenditure (% of GDP)

	Period									
Country Name	05	06	07	08	09	10	11	12	13	14
Finland	3.33	3.34	3.35	3.55	3.75	3.73	3.64	3.42	3.30	3.17
Sweden	3.39	3.50	3.26	3.50	3.45	3.22	3.25	3.28	3.31	3.16
Denmark	2.39	2.40	2.51	2.78	3.07	2.94	2.97	3.03	3.08	3.08
Austria	2.38	2.37	2.43	2.59	2.61	2.74	2.68	2.89	2.96	2.99
Germany	2.42	2.46	2.45	2.60	2.73	2.71	2.80	2.87	2.83	2.87
Belgium	1.78	1.81	1.84	1.92	1.99	2.05	2.16	2.36	2.43	2.46
Slovenia	1.41	1.53	1.42	1.63	1.82	2.06	2.42	2.58	2.60	2.39
France	2.04	2.05	2.02	2.06	2.21	2.18	2.19	2.23	2.24	2.26
United Kingdom	1.63	1.65	1.68	1.69	1.74	1.69	1.69	1.62	1.66	1.70
Ireland	1.19	1.20	1.23	1.39	1.61	1.61	1.53	1.56	1.54	1.52
Greece	0.58	0.56	0.58	0.66	0.63	0.60	0.67	0.70	0.81	0.84
Bulgaria	0.44	0.44	0.43	0.45	0.50	0.57	0.54	0.61	0.64	0.80
Croatia	0.86	0.74	0.79	0.88	0.84	0.74	0.75	0.75	0.82	0.79
Latvia	0.53	0.65	0.55	0.58	0.45	0.61	0.70	0.67	0.61	0.69
Cyprus	0.37	0.39	0.40	0.39	0.45	0.45	0.46	0.43	0.46	0.47
Romania	0.41	0.45	0.52	0.57	0.46	0.45	0.49	0.48	0.39	0.38
European Union	1.75	1.77	1.78	1.85	1.94	1.93	1.97	2.01	2.03	2.03
World	1.99	1.99	1.97	2.03	2.06	2.06	2.05	2.13	2.12	2.14

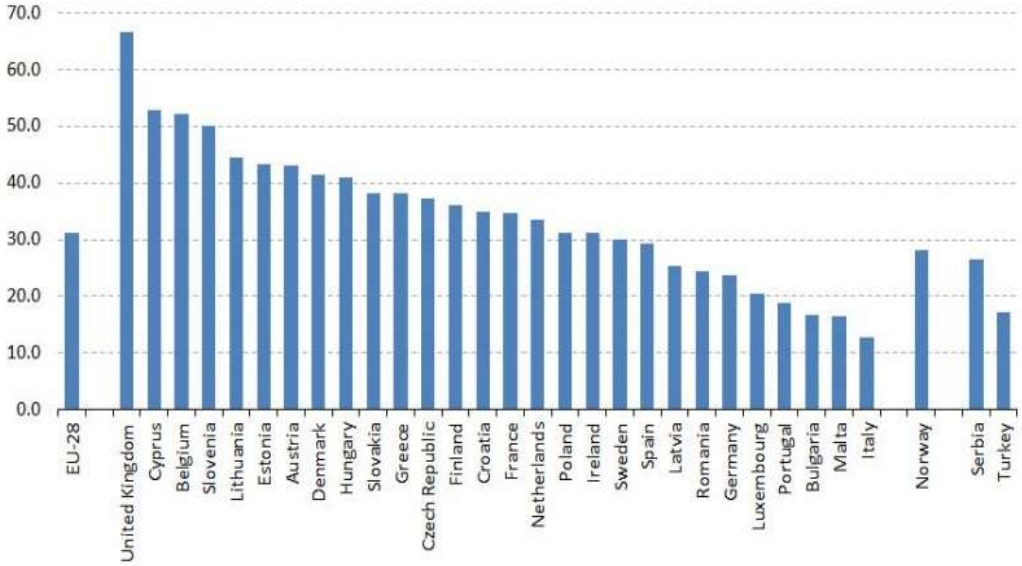
Sourse: Eurostat. *The table is presented in abbreviated form*

According to 2015 performance, the difference in the share of expenditures on R&D between the leaders and outsiders differs almost 8 times. In terms of innovative development asymmetry, the EU has to put a lot of effort to equalize the basic parameters forming an innovative strategy at the regional level.

The UK has the largest number of enterprises participating in various kinds of cooperation. According to 2012 performance, the share of innovative enterprises using cooperation with other agencies in the UK was 66%, almost twice as much as in the whole EU. The most active countries in this area include Cyprus, Belgium and Slovenia. In Sweden, the leader of innovative development of the EU, only 30% of innovative enterprises are involved in cooperation (Figure 2).

University of Auckland Business School researchers say (University of Auckland, 2017) small businesses need to get used to the idea of collaborating with other companies if they want to boost their bottom lines. Researchers drew on their earlier extensive survey of SMEs in manufacturing and service industries, called "Growing New Zealand Businesses". They compared the three strategies that owner-managers in the survey said they used for innovation: training-only, collaboration-only, and combined collaboration-and-training. Researchers analysed the responses of 839 participants in the Growing New Zealand Businesses survey.

Figure 2. Innovative enterprises engaged in any type of cooperation, by country, 2012



Source: Europe 2020 indicators - research and development

The mean number of employees was 25, 45 percent of businesses were micro (1-9 employees), 40 percent were small (10-49) and 15 percent were medium-sized (50-249). They found:

- For young firms (15 years or younger), collaboration alone led to a positive impact on innovation – especially for high-tech firms

- For mature firms (over 15 years), both training and collaboration strategies were important for success
- Training alone gave no innovation boost to either young or mature firms.

In the conditions of asymmetry of innovative development, the mechanisms of integration get the signs of internationalization, strengthening of state-private partnership (including on the basis of private innovative capital financing), and university co-operation, scientific - research and commercial structures The countries-leaders of innovation development are interested in efficient financing of innovation activities by prioritizing, attracting partners and distributing financial commitments among stakeholders. The development of economy of knowledge needs the use of significant financial resources based on a combination of various financial instruments. Reducing the disparities in innovation development should be based on a balanced regional innovation policy that takes into account the existing innovation potential of enterprises and organizations and facilitates the exchange of experience in the field of implementation of innovative projects.

Conclusions

The mechanisms of integration in science and innovation can be quite diverse and include participants with different resource support, level of knowledge and experience. The EU faced the problem of different levels of development of its member states in the field of innovation as well. The capabilities can be aligned through redistribution of funds. One should not forget the fundamental Riesenhuber criteria, defining the nature of research priorities:

- research conducted on so vast a scale that single Member States either could not provide the necessary financial means and personnel, or could only do so with difficulty;
- research which would obviously benefit financially from being carried out jointly, after taking account of the additional costs inherent in all actions involving international co-operation;
- research which, owing to the complementary nature of work carried out at national level in a given sector, would achieve significant results in the whole of the Community for problems to which solutions call for research conducted on a vast scale, particularly in a geographic sense;
- research which contributes to the cohesion of the common market, and which promotes the unification of European science, and technology; as well as research which leads where necessary to the establishment of uniform laws and standard.

As the analysis shows, the developed countries have long ago understood the effectiveness of the mechanism of cooperation in various fields of science and innovation. This trend is clearly demonstrated by the UK. Bringing innovation to business structures enables the efficient management of public funds on the one hand, and attracting private capital on the other.

The EU experience in innovation network forming and implementation of various forms of integration have long crossed the boundaries of the economic union. The framework system allows the countries which are not EU members to participate in various projects. The method of selecting the projects for funding focuses on innovative potential of the creative team, which includes knowledge, experience, quality of management, existing logistics etc. In international innovation process, networks play the role of a consolidator and integrator of efforts to achieve a common goal.

Selective study of the strategic integration directions in the innovation field of same EU countries and key indicators of innovation activity gives reason to assert that the unevenness of innovation development corresponds to the directions and forms of integration, which are being used. Leading countries take an active part in global science and innovation by creating innovative networks, international clusters based on a high level of internationalization of human resources. Instead, modest innovators are focused on collaborating with regional innovation networks, formation of clusters with the involvement of academic institutions, universities, business structures of the regional level and municipalities.

Innovation development strategies need to be periodically monitored and adjusted, taking into account changes in the models of innovation processes. Since we have limited our research by supranational interstate management bodies to which the EU belongs, the results of the study also relate to those integration mechanisms and models of innovation that have developed within this economic union. There is a lagging EU spending on research and development from the world level, as well as from countries such as South Korea, Japan, and the USA. The opportunities of private business in financing research are underestimated.

Japan's and South Korea's private business participation in research funding amounts to 75% of all costs. In the EU, this figure is 55%. Not all innovative enterprises are involved in various forms of cooperation, which limits the existing innovation potential and constrains the synergy of mutual development.

In our opinion, in order to equalize the asymmetry of innovation development in the EU countries, it is necessary to conduct a revision of the models of their national innovation systems on the subject of their compliance with the goals of innovative development; to pay attention to the

development of venture capital markets; to investigate the impact of taxes on the activation of investment processes.

Even the most advanced forms of international integration of innovation will always evolve in space and time, looking for the more effective mechanisms of cooperation. Subsequent research will be aimed at exploring the forms of cooperation and models of innovation in countries that are leaders in the world.

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Annex 1

The evolution of the innovation processes models

Period	Name of the stage	Features	Integration links
From 1950 to the mid-1960's	Technology Push	Companies focused predominantly on scientific breakthroughs. R&D was considered as corporate overhead and relegated to an 'ivory tower' position. Innovation occurred at the fast growing multinationals isolated from universities.	No links
The mid 1960's to early 1970	Market Pull	The central focus became responding to the market's needs. Cost-benefit analyses were made for individual research projects including systematic allocation and management of resources. Stronger connections were initiated between R&D and operating units by including product engineers in scientist run research teams in order to decrease time to market.	Between R&D and operating units
From the mid 1970's to the mid-1980's,	Coupling Of R&D And Marketing	The strategic focus was on corporate consolidation and resulted in 'product portfolios'. Companies moved away from individual R&D projects. Marketing and R&D became more tightly coupled through structured innovation processes. Operational cost reduction was a central driver.	Between Marketing and R&D
From the early 1980's to the mid-90's,	Integrated Business Processes	The focus was on integrated processes and products to develop 'total concepts'. Typical of this fourth generation was the 'parallel and integrated nature' of development processes. Externally, strong supplier linkages were established as well as close coupling with leading customers.	Communication with suppliers and leading clients
From the 1990's	System Integration & Networking	Business processes were automated through enterprise resource planning and manufacturing information systems. Externally, the focus was on 'business ecosystems'. Advanced strategic partnerships were setup as well as collaborative marketing and research arrangements such as 'open innovation'.	Advanced strategic partnerships, collaborative marketing and research arrangements' open innovation'.
From the 2000's	Hidden Knowledge And Quick Learning	The competitiveness and advantages of the organization are mainly based on not explicit, but hidden knowledge and training	Economic net-work (enterprise, institutions, departments, various forms of cooperation, technical infrastructure for the exchange of knowledge)
From the 2000's	Open Innovation	Research field expansion allows to find and implement ideas faster than with traditional covered "model of innovation"	Long-term partner-ships relations
From the 2010's	Innovation network/ international research networks	They foster the very culture of collaboration, bringing together corporate units (R&D, business development, marketing, etc.), provide intellectual and operational support for the company's external innovation programs	Business processes of the enter-prise are involved in the implementation of external innovation programs
	Collaborative Innovation Network (CoIN)	A using of the internet platforms such as email, chat, social networks, blogs, and Wikis to promote communication and innovation within self-organizing virtual teams. CoINs rely on modern technology such as the Internet, e-mail, and other communications vehicles for information sharing. Creativity, collaboration, and communication are their hallmarks	Smart procurement, collaborative innovation projects, smart direct investments, joint ventures, and strategic innovation partnerships

Source: Davis et.al., 2015; Chesbrough and Schwartz, 2007; Chesbrough, 2003; Enkel et.al., 2009; Giannetto and Wheeler (2000)

Annex 2

Directions of strategic integration in the innovation sphere

The EU	- better integration of capital markets; - skills training; - the progressive integration of firms, especially SMEs, in global value chains, and - more lending for innovative and industrial projects. - improve framework conditions and access to funding for research and development in order to transform innovative ideas into products and services that provide growth and employment
Switzerland	- a high level of internationalization of human resources, both in businesses and universities, and favourable conditions to attract FDI. - support of both outward and inward international scientific mobility - a variety of programs to provide financing, professional advice and networks, in particular to start-ups and SMEs - the Commission for Technology and Innovation (CTI) Vouchers, with a budget of (CHF 1 million in 2014), helps SMEs to get an expert assessment of their innovation projects and to search for innovation partners; CTI grants for collaborative R&D projects, with a 2014 budget of CHF 117 million), financially supports joint projects between firms and HEIs; CTI National Thematic Networks (NTN), 2014 budget of USD 1.9 million (CHF 2,5 million), aims at providing SMEs with access to science-based research findings; CTI Innovation Mentors (IMS), 2014 budget of (CHF 1 million), provides mentorship to SMEs on innovation challenges and to search for innovation partners in academic institutions.
United Kingdom	- participation in global science and innovation - the UK has become a partner of choice for research collaboration, with 48% of all UK articles in 2012 resulting from international collaboration - in 2011, the UK attracted almost $7 billion of overseas-financed R&D. This is the same as in Canada, Finland, Japan, China, and Russia combined, more than either France or Germany ($4 billion each) and just under half that of the USA (with $16 billion) - since 2008, the percentage of business R&D financed from overseas has remained comfortably above 20% for the UK, which compares to less than 14% of all our comparator countries
Germany	- German industry and science have strong links, and a very high proportion of public research is funded by industry - creation of new instruments to improve regional, national and international networking between science and industry - funding of efforts for internationalisation of clusters, developing technology specific open innovation research programmes and dual vocational training systems, and creating incentives for public procurement by municipalities - The Kopernikus Projects (from 2016) bring together scientific institutions and universities, private companies, and organised civil society in large consortia to work together for up to ten years to develop technological solutions for the transformation of the energy system. - the strategic development and intensification of collaboration with firms and other societal stakeholders - implementation of new networks (Innovationsforen Mittelstand) and making use of existing ones to develop strategic cooperation between SMEs and strong partners (KMU-NetC)
Finland	- expansion of the economic and social impact of research and development through enhanced co-operation between HEIs and businesses and further commercialisation. - a key tool to improve the R&D impact is to encourage the profiling and division of work between HEIs and state-funded research institutes. - encouraging the municipalities to utilise their significant future investments as platforms to develop innovations in cooperation with businesses. - Government has also allocated USD 15.2 million PPP (EUR 14 million) for Innovation Funding Agency Tekes to speed up commercialisation of research results by strengthening cooperation between HEI's, state-funded research institutes and companies - promotion of international mobility of researchers by providing grants for research stays and joint projects abroad.
Czech Republic	- the Czech Republic is also currently preparing an Action Plan for International Cooperation of the Czech Republic in R&D and Internationalisation of R&D system in the Czech Republic for the years 2017 2020, which will also address human resources from the point of view of international mobility

	- Major national initiatives to promote the internationalization include CZ COST, EUREKA CZ, KONTAKT II, II and INGO EUPRO II program to be implemented in 2017 and gradually replaced the program INTER-EXCELLENCE (2016 2024). - The Technology Agency of the Czech Republic (CTA) administers the following programs: ALFA (2011 19), which aims to stimulate R&D cooperation between businesses and research organizations; DELTA (2014 19), which is intended to support collaboration in applied research and experimental development through joint projects between enterprises and research organizations; ZETA (2012 17), which aims to increase co operation between academia and companies. - Competence Centres (Centra Kompetence 2012 19) support the development of long-term collaboration between the public and private sectors.
Latvia	- the system is rather well connected to regional, EU and, to a lower extent, global knowledge and innovation networks - The Baltic inter-ministerial expert group and the Baltic-Nordic co-operation on research infrastructure are regional platforms for co-operation and assistance. - the Programme on Co-operation in Science and Technology between the Ministries of Education and Science of Ukraine and Latvia intends to trigger exchange and co-operation between researchers in both countries - as a part of the Guidelines of Science, Technology Development and Innovation 2014-20 Latvia launched an EU financed post-graduate grant programme to spur international mobility of young researchers willing to work abroad. - since 2009, the industry-driven cluster initiatives have received support in order to promote collaboration between unrelated companies, research, educational and other institutions and to improve the competitiveness of enterprises, increase export volumes and promote innovation and development of new products. - support for cooperation between industry and academia and commercialization of research results, new product and technology development and the expansion of innovative and technology-oriented companies as well as new financial instruments (e.g. seed and venture capital) for innovative companies

Source: The Innovation Policy Platform (IPP), European Commission (2010, 2011)