

SCIENCE AND EDUCATION FOR SMART GROWTH IN THE CONTEXT OF THE INNOVATIVE STRATEGY FOR INTELLIGENT SPECIALIZATION OF THE REPUBLIC OF BULGARIA

Venelin Terziev¹ and Margarita Bogdanova²

¹Academician of the Russian Academy of Natural History, Moscow, Russia, Prof.
D.Sc.(Ec.), D.Sc. (National Security), D.Sc. (Social Activities), Ph.D., National Military University,
Veliko Tarnovo, Bulgaria; University of Rousse, Rousse, Bulgaria, terziev@skmat.com

²Prof. Ph.D., D.A. Tsenov Academy of Economics, Svishtov, Bulgaria,
mbogdanova@uni-svishtov.bg

Abstract

The report presents a comparative analysis of different policies and approaches for management of centers of excellence (CoE) and centers of competence (CoC) in the context of the convergence of science and technology policy. The potential challenges to its successful implementation in Bulgaria are outlined. Best practices and management models in the USA, UK, Denmark and Finland are discussed. Among the main problems in Bulgaria are the short horizon of integration between the efforts of universities and research organizations on the one hand, and business and public sector on the other, the lack of private investments for the development of research, the need for reforms in higher education aimed at improving the quality of education.

Keywords: Centers of excellence (CoE), Centers of competence (CoC), convergence of scientific and technological policy.

1. INTRODUCTION

In the recent years, the subject of convergence in the scientific and the technological policy grows more and more topical and significant for the development of an economy and even society, based on knowledge. Universities' and research organizations' efforts integration on one hand, and of the businesses and the public sector's on the other hand, becomes a key circumstance for building capacity for innovations. According to some estimation, this is the third economic revolution in human history, which is expected to radically change the way of making business, the environment for living's qualities and the society as a whole.

In this complicated, dynamic environment, higher schools and the research organizations acquire bigger and bigger role of a motor and initiator of development. They are part of the „triple helix“ that embraces the system „university – business – government“. They perform the so called „third mission“, directed towards encouraging the relations with users of knowledge and towards facilitating the technologies transfer. This new higher schools social role puts them in front of series of challenges that could be over taken through

innovative approaches and use of all possible tools for facilitating the knowledge and technologies transfer.

The Centers of Excellence and the Centers of Competence, which are to be established in Bulgaria in the following years, are among the most modern possibilities for intervention up to now.

The topic about the Centers of Excellence (CoE) and Centers of Competence (CoC) is perhaps the most update and significant for the higher schools at home to the very present moment. It is in the agenda of Operative Programme „Science and Education for Smart Growth“ (OP SESG) and of many higher schools that elaborate project documentation and prepare for managing multi-disciplinary research centers with high potential for scientific results in priority for the country subject fields.

That is why the scientific community's excitement and the expectations of all interested parties for the results and impact of this type of initiatives are great. Beside the planned direct results such as number of publications and hired researchers, in a longer term plan it is expected for the whole picture of scientific infrastructure to change, conditions for successful career for young researcher to be established and the significance of higher schools and research institutions for the development of economy based on knowledge to change.

2. INTELLIGENT SPECIALIZATION

Intelligent specialization is a strategic approach towards the economic development through purposeful support for scientific researches and innovations. It is in the base of the European structural and investment funds interventions in the field of research and innovations as a part of the contribution of the current national policies and the cohesion policies according to the Growth and Employment Strategy Europe 2020. Intelligent specialization includes process of elaborating vision, identifying the competitive advantages, defining strategic priorities and use of intelligent policies for maximizing the potential for development, based on the knowledge of each region. The Innovation strategy for intelligent specialization is based on the „process of entrepreneurial discovery“ for defining the economic priorities within the scientific-research and innovation activities, aiming establishment of competitive advantage through development and complying own strong aspects in scientific research with the needs of industry. The goal is to meet the new market's possibilities and changes, concentrating investments in the fields that ensure economy's added value increasing and its competitiveness on the international markets. ISSS in its essence is a process that would continue during the entire programme period 2014-2020.

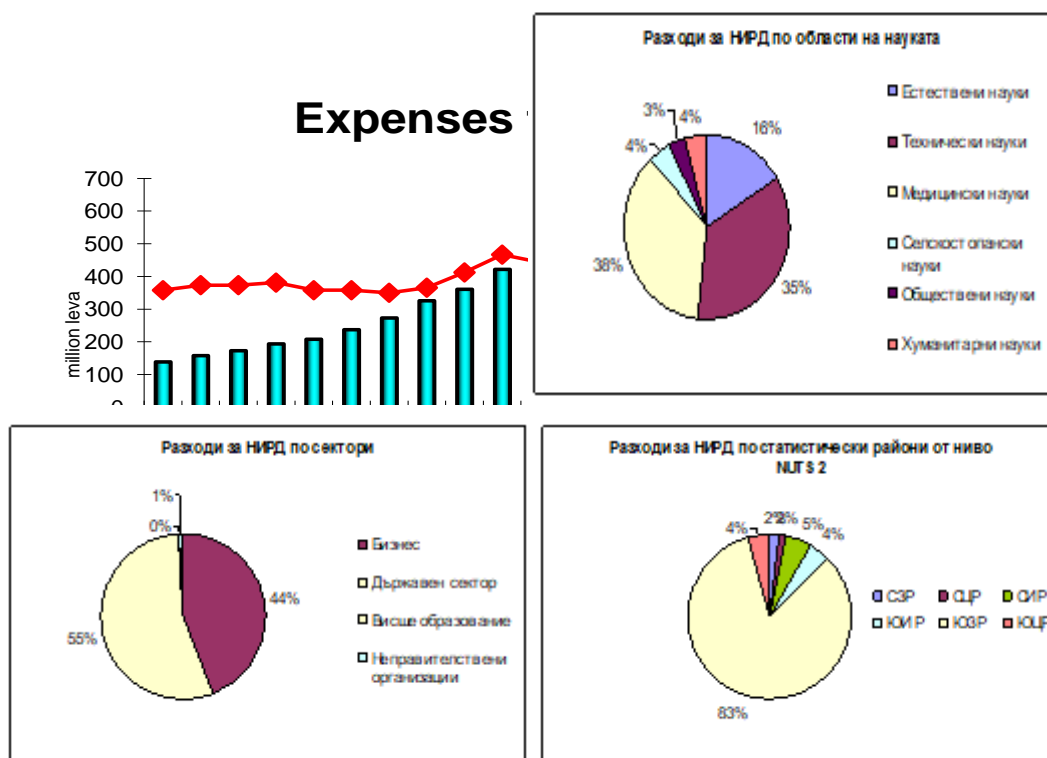


Fig. 1. Expenses for SRDA

The analysis made in the ISSS action plan allows drawing some important conclusions:

- The expenses for SRDA are still insufficient;
- The expenses for SRDA are predominantly concentrated in the field of medicine, technical and natural sciences (89 %);
- Business considers the need of expenses for SRDA;
- Business's expenses for SRDA are mainly in the processing industry (about 52 %);
- The expenses for SRDA are distributed quite unevenly by regions – 83 % are in the Southwestern region.

The vision of the Innovation strategy for intelligent specialization of the Republic of Bulgaria is: „To the year 2020, Bulgaria to make a quality leap in its innovation presentation at level EU for coping with the social challenges in the field of demography (reducing brain-drain, attracting the successfully established Bulgarians, stimulating youth entrepreneurship), sustainable development, intellectual capital and nation's health“.

Strategic goal: To the year 2020 Bulgaria to move from the group of „timid innovators“ to the group of „moderate innovators“.

Practically this change in indicators would take place at an effective policy encouraging the following:

- Innovations, scientific research and human capital development,
- Investments in highly technological fields, where Bulgaria has traditions, has established experts and is successfully competing on the international market,
- Export-oriented industries.

The strategic goal would be achieved with achieving two operative goals:

Goal 1: Focusing the investments for developing innovative potential in the identified subject fields (for establishing and development of new technologies, leading to competitive advantages and increasing national products and services added value)

Goal 2: Support for accelerated mastering of technologies, methods, etc. that improve resource effectiveness and the application of ICT in all industries enterprises.

The process of intelligent specialization identification is dynamic, with the participation of partners from the economic and the scientific fields as well as the civil society in order to identify the fields, where the country has chance to be distinguished and to demonstrate its face on the international market.

The measures undertaken for continuing the process of entrepreneurial discovery would allow the fields, where there is potential for growth and which would contribute most for solving social-economic challenges in front of society to be supported.

The subject fields for intelligent specialization identification is grounded on the principle „from technological to subject fields for intelligent specialization“ (Fig. 2 and 3, Table 1).



Fig.2. From technological to subject fields of intelligent specialization

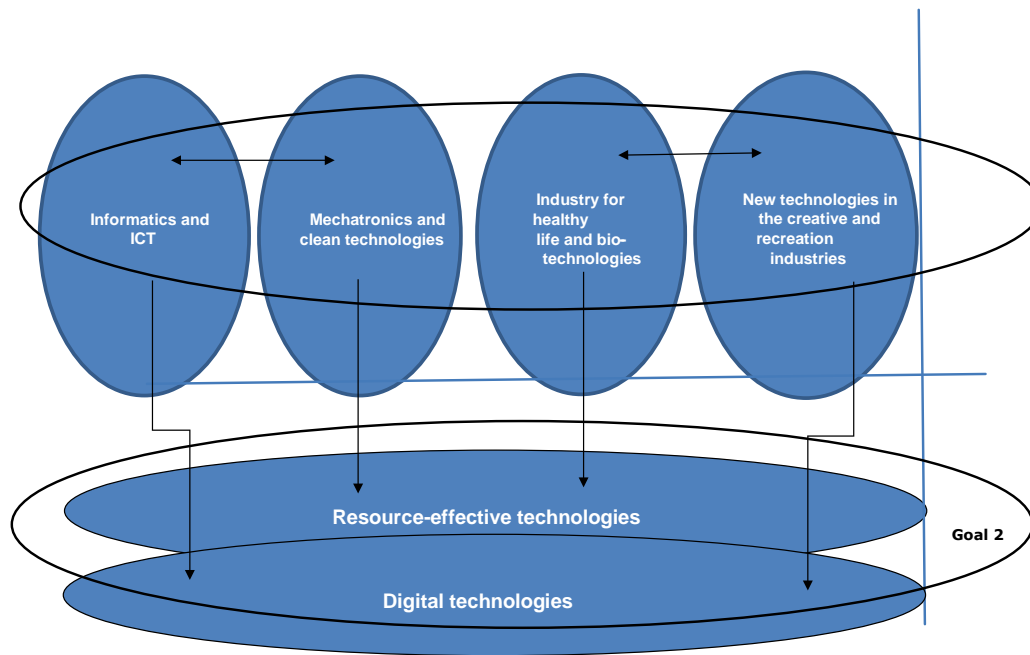


Fig. 3. Scope of ISSS operative goals

Table 1. ISSS subject focus.

<p>Informatics and ICT</p> <ul style="list-style-type: none"> • productions, particularly Fabless and new approaches for design and/or assembling; • ICT approaches in machine building, medicine and creative industries (in connection with the other three subject fields), including digitalization of cultural-historical heritage, entertaining and educational games, “embedded” software; • 3D digitalization, visualization and prototyping; • Big Data, Grid and Cloud Technologies; • Wireless sensor networks and wireless communication/management; • Language technologies; • Web, hybrid and "native" applications, web based applications for establishing and exploitation of new services and products; • Use of new possibilities in connection with outsourcing and ICT-based services and systems. 	<p>Mechatronics and clean technologies</p> <ul style="list-style-type: none"> • production of base elements, details, nodes and equipment, integrated as part of mechatronic aggregate or independently composing such aggregate; • machine-building and device-building, including parts, components and systems, with stress on transport and energetics; • engineering, re-engineering and continuing the life cycle of industrial machines, devices and systems; • robotics and automatization of projects; • design and production of highly technological products and/or participation in over-national production chain, including in aero-space industry; • bio-mechatronics; • intelligent systems and devices, „intelligent homes“ – “intelligent towns”; • clean technologies with stress on transport and energetics (storing, saving and effective energy distribution, electric vehicles and eco-mobility, hydrogen based models and technologies, non-waste technologies, technologies and methods for waste products and materials from one productions to other).
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<p>Industries for healthy life and biotechnologies</p> <ul style="list-style-type: none"> • Production, storage, processing and reaching the end user of specific Bulgarian ingredients, items and products (including yoghurt, honey and bee products, bread, beer, wine, dairy and meat products, essential oils, herbs and herbal products, cosmetic items and products); • Production of specialized food and beverages (baby's and children's, „space“ food); • Production of instruments, equipment, consumables for medical and dental diagnostics and therapy and/or participation in supranational production chain; • Personal medicine, diagnostics and individual therapy, curative and medical forms and items; • Medical and curative tourism with a stress on the possibilities for personalization (non-mass, but personal); • nano-technologies in service of medicine; • bio-technologies with direct application for healthy lifestyle; • „blue“ technologies and application of new methods and technologies in river and sea resources sustainable use; • Production of installations for ecologically clean energy and industrial water; • Green economy - technologies, products, processes. 	<p>New technologies in creative and recreation industries</p> <ul style="list-style-type: none"> • cultural and creative industries (according to EC definition: architecture, archiving activities and librarianship, artistic craftsmanship, audio-visual forms (movies, TV, video games and multimedia), cultural heritage, design, including fashion design, festivals, music, stage and visual arts, publishing, radio; • computer and mobile applications and games with educative, marketing and/or entertainment characteristics; • alternative (rural, eco-, cultural, festival) and extreme tourism and sport (for stimulating non-seasonal but continuous niche tourism); • production of goods and appliances with direct application in these fields (e.g. national (regional) folklore costumes, bicycles, climbing walls and other goods for alternative and extreme sports, costumes, scene-sets, materials for historical re-enactments, specialized outfit and equipment, printed materials).
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Table 2. Subject fields' regional focus

Northwestern region	North central region	Northeastern region
Mechatronics and clean technologies	Mechatronics and clean technologies	Mechatronics and clean technologies
Industry for healthy life and biotechnologies	Industry for healthy life and biotechnologies	Industry for healthy life and biotechnologies
New technologies in the creative and recreational industries	Informatics and ICT	New technologies in the creative and recreational industries
Southwestern region	South central region	Southeastern region
Informatics and ICT	Informatics and ICT	New technologies in the creative

		and recreational industries
New technologies in the creative and recreational industries	Mechatronics and clean technologies	Mechatronics and clean technologies
Industry for healthy life and biotechnologies	Industry for healthy life and biotechnologies	Industry for healthy life and biotechnologies

Table 3. Policies and tools for ISSS 2014-2020 implementation

Indicative activities	Tool	Planned source of financing	Indicative budget 2014-2020
GOAL 1: Focus on the innovation potential in the identified subject fields (for new technologies establishment and development, which would result in competitive advantages and increasing national products and services added value)			
SUB-GOAL: Effective cooperation science-business			
Cooperation stimulating	Grant scheme for innovations in enterprises	Operative Programme Innovations and Competitiveness /Horizon 2020/	460 million Euro
	Grant schemes/vouchers for joint projects	OPIC /Horizon 2020/	
	Grant schemes for mediation (clusters, OTT, technological centers)	OPIC, National Innovation Fund, National Science Fund / Horizon 2020/	
	Stimulation of offering quality researches	NIF, NSF / Horizon 2020/	
Purposeful efforts for encouraging cooperation	Centers of competence, centers of excellence, Regional scientific centers	OP SESG	350 million Euro
SUB-GOAL: Quality human resource			
Strengthening the connection between HE and the labour market requirements; stimulating training in technical and engineer specialties; strengthening higher	Support for practices, Ph.D. candidates and post-Ph.D. candidates, scholarships and distinctions, schemes	OP SESG, other EU programmes	90 million Euro

education practical application	for knowledge, skills and qualification enhancement		
Vocational education and qualification reformation and life-long learning encouragement	Schemes for vocational training and qualification Support for informally acquired knowledge and skills recognition	OP SESG, other EU programmes	50 million Euro
Internationalization of innovations for additional scientific-research activity enhancement and mastering the phenomenon „brain-drain “	Support for participation in international projects	Operative programme Human Resources Development, OP SESG, other EU programmes	70 million Euro
SUB-GOAL: Adequate environment and infrastructure for innovations, including digital growth and e-government			
Development of adequate and secure environment for innovations creation and dissemination	Sofia Tech Park Innovative services for the business	OPIC	40 million Euro 20 million Euro
E-infrastructure and e-government	E-government E-justice	Operative Programme Good Governance	140 million Euro 35million Euro
GOAL 2: Support for accelerated mastering of technologies, methods, etc. that improve resource effectiveness and the ICT application in all industries enterprises			
SUB-GOAL: Innovations for resource effectiveness			
In the field of waters In the field of waste Information and publicity		OPIC, ОПОС /Norwegian Programme, NIF, Horizon 2020/	40 million Euro
SUB-GOAL: Innovations for ICT applications introduction			
ICT applications in the whole industry (software applications, system software, software for development – tools for computer programming)		OPIC, /Horizon 2020 NIF, EXCELL /	80 million Euro

ISSS offers system for identification and support of the intelligent specialization fields such as:

- Engages leading entrepreneurs and partners in the development and innovative activities from scientific circles and business;
- Concentrates on the national specialization fields support;
- Integrates the process from bottom-upwards and from top-downwards;
- Is grounded on data and facts;
- Concentrates the expenses for scientific research and innovations by eliminating non-profitable phenomena like fragmenting and duplicating of funds for research;
- Points cross-sectoral fields of specialization;
- Creates conditions for increasing private investments in scientific research and innovations.

Improving the cooperation between research institutes and the business would require combinations of approaches for “active demand” and “quality (scientific) supply”. Good cooperation requires relevant infrastructure (2018a-o; 2012a; Dag Aksnes , 2012b; Etzkowitz, Leydesdorff, 1998a; Etzkowitz, 2000a; Gulbrandsen, Slipersaeter, 2007a; Miller, McAdam, McAdam, 2014a; Lemola, 2002a; 2017a-b; 2010a).

3. CONCLUSION

Negative trends connected with scientific and innovation activities' development in the country as well as the educational system, and particularly higher education, are the grounds for number of important issues, which solution requires systematic approach.

First, it is necessary to give priority to the investments in infrastructure that contribute to specialization in the ISSS fields.

Second, it is necessary to establish national system for using big scientific-research infrastructures, established with public funds – with publicly accessible map of scientific equipment, clear rules for its use, wide access for the public organizations and the business, maximum effectiveness and unified system for the public results distribution.

Third, it is necessary to support the leading regional universities and scientific centers in order them to adapt to the new ISSS priorities – this would require modernization of their laboratories and equipment for scientific research, in order their scientific research capacity to improve and to be given opportunity to render the relevant business-oriented services.

Like most of the tools, if applied separately, CoE and CoC would not be able to solve all problems of scientific research development in Bulgaria, but would contribute to partly overcome the crisis with the lack of financing in favour of innovative, transformation focused projects.

CoE are initiatives that stimulate the elitist character of research. That is why achieving public consensus is important for balancing and overcoming of elitist attitudes for financing each one but with little. Precisely such is the problem of the system in Bulgaria – conflict of egalitarian approach of training financing and the elitist character of scientific research financing.

Because of the present publication limited volume and the great number of problems that are to be covered, issues like the following are left outside the scope of the report:

Assessment of the impact of CoE and CoC, which is to be made as well as scenario of the possible changes in the field of Higher Education;

The business models of CoE and CoC management, which are to be completely different from the ones for the higher schools, where they would be unfolded;

Models of successful partners relationships in the CoE and CoC, where there are consortiums of several organizations;

Necessary competencies for network work with representatives of NGOs, the public sector and the business, etc.;

Business's attitude, what is the extent of it readiness to participate and to invest;

Place of university students in scientific-research projects, etc.

Yet, at the stage of applying, all teams of CoE and CoC should include experts with good prognostic skills in

order to adequately assess the perspectives for realization of innovative products and research results. Prognostics have to be based on combination of quantity and quality methods. Only this is a serious and responsibility requiring task that requires expertise and experience in scientific-research prognostication and such experts are not available often.

Some important problems have to be solved in short and long term:

The mandatory trainings that would be organized under technical aid under OP SESG have to include trainings in organizational management of programmes and projects, rules for monitoring and report of results, communication strategies, procurement, etc. Otherwise, organizations, especially when they are in consortium, take the risk of making costing mistakes and of being forced to reimburse funds after they are already spent.

Perhaps at a future stage, when conclusions are drawn for the present procedure weaknesses and when administrative capacity is accumulated in the managing body as well as in the potential beneficiaries, it would be possible to move to two-stage procedure, where only concept is submitted at the first stage, and the detailed development of the project is made at the second stage. This would relieve the process of preparation and beside that, the attention would be entirely directed to the research programme quality and innovativeness, without focusing on capacity that much during the first stage of applying.

It is of quite a significance the relevant reforms in higher education to be undertaken for they would solve at least partially the problem with the quality of training in educational-qualification degree „bachelor“ and educational-qualification degree „master“. Research sector, which anyway suffers lack of trained and motivated candidates and talents-drain, cannot be supplied without availability of well-prepared cadres. In that regard, stimuli for university student inclusion in scientific-research projects are necessary. The initiative „Science Shop“ could be introduced for more young people to be attracted to the field of science.

Part of these preliminary conditions for scientific research success are developed also in the draft for National Strategy for Scientific Research Development to 2025, and in Operative Programme Science and Education for Smart Growth, but not always the technology and mechanisms for their achieving are clear.

The change in the way of universities' management is one of the possible effects from CoE and CoC. For the first time in our country there would be possibility to establish the so called „entrepreneurial universities“ and to apply, although to quite a conditional extent, the approaches of the new public management in higher schools' administering. But as far as this is a broad topic requiring special attention, it wouldn't be developed in the present report.

Other countries' practice shows that a lot of CoE and CoC have already ceased to exist after research program's completion. In this sense, CoE and CoC are not eternal. They depend on the activity and initiatives of the management, on its flexibility, on the actuality and significance of scientific-research goals and tasks.

Centers of excellence and competence are more than just scientific infrastructure tools. They are a cause that opens new possibilities for quality research, for achieving international recognition and for improving the image of Bulgarian science. In order to be successful, however, they should be competently managed with participation of all interested parties.

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