



OF SOME SPECIFICS IN IMPLEMENTATION OF INTERNATIONAL PRACTICES FOR TECH TRANSFERS OF BIOTECH INNOVATIONS / THE CASE OF THE BULGARIAN UNIVERSITY PLATFORM “VITA PLUS”/

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ABSTRACT

The first-of-its-kind University of Plovdiv transdisciplinary project “Vita Plus” is deemed to adopt some positive international practices to initiate and announce that there are researchers at the University of Plovdiv, interested in realizing tech transfers in the field of biotech innovations. Thus, *the goal* of the present paper is to explain what factors might be crucial to both characterize technological transfer of biotech innovations as successful from University researchers’ viewpoint, and present them to business ventures for commercial purposes. *Research methods* of the study include data of the most recent thematic study of the World Bank on Bulgaria and analytical reviews of contemporary scientific literature to establish a modern Bulgarian platform for transfer of biotechnological know-hows to bio-based industries in the forthcoming era of bioeconomy. *The results* of the research are aimed at formation of comparative-analytical parameters and benchmark indicators for economic valuation of implementation of biotechnological solutions in the emerging Bulgarian circular economy, based on observations at the “Vita Plus” project. *Conclusions* relate to derivation of a set of recommendations for formation of a new integrated approach for creating a working model for technological transfer of University researches and solutions in real bio-based industrial production through the University platform “Vita Plus”.

Key words: technology transfer, biotech innovations, circular economy, bioeconomy

INTRODUCTION

It was the most recent World Bank Report of 2020 on Bulgaria [1], which provoked serious academic attention on problems and risks related to technological transfers, induced by Universities and R&D Centers at the beginning of the new EU programming period /2021-2027/, as Bulgaria is a full EU member and must comply to the political shift and business restructuring towards bioeconomy. Overall, the Report

illustrated the significant lagging behind of Bulgarian Universities and R&D Centers. They lack adequate knowledge and finance to exercise successful University entrepreneurship practices to valorize, monetize, commercialize their intellectual products. It is demonstrated in this Report that private businesses in Bulgaria contribute 70% of R&D financing as percentage of GDP, Bulgarian Government – 23%, whilst Bulgarian Universities contribute 6%, only [1, p. 46, Figure 27]. Although there are numerous University policies, which declare to foster creation and transfer of intellectual property to interested stakeholders, this is not the case, at all. In fact, there are fragmented or no structured processes for design, creation, defense, and transfer of intellectual products or technologies,

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produced in Bulgarian Universities by Bulgarian researchers. This is observable through the Vita Plus project, as well. The intellectual property defense and market promotion system of policies is outdated and does not correspond to market reality. And, this is the main reason for intelligent and successful researchers to search for real job opportunities to produce intellectual products for gains in the private sector rather than staying at state-owned Universities and R&D Centers. This Report demonstrates also that there were about 4'500 researches in the private sector in 2013, while in 2018 they almost tripled to 15'775 [1, p. 48, Figure 31]; in addition, Bulgarian science is classified at the last place in the international ranking of h-index, which measures productivity and impact of cited publications. Furthermore, Bulgarian Universities produced only 3 patents in 2018.

All these facts and figures clearly demonstrate that Bulgaria is far behind of even average international practices in modern economies, and cannot mobilize critical mass of qualified experts at this point to initiate development and sale of own technologies to interested third parties.

This turns into a critical issue about capability of Bulgarian University and R&D system. In general, innovation processes include a set of numerous highly profiled and specialized activities, aimed at practical implementation of ideas, where time and budget constraints are crucial for successful market development. In addition to lack of time and budget problems, majority of Bulgarian researchers cannot work in internationally competitive environment and at this point are incapable of producing commercially sustainable intellectual products and technologies. The problem is even more serious, when it comes to advanced R&Ds, such as biotech innovations, which are applicable in cosmetics industry, food industry, pharmaceutical industry, and many others bio-based industries.

Having in mind the big picture, and to counter-balance the general trends in Bulgarian academic environment, the University transdisciplinary project Vita Plus /2021-2022/ is deemed to test a collaborative scientific approach of professionals

of different academic background, such as Chemistry, Biology, Physics, Economy, Finance, Sociology, Law to produce a series of integrated intellectual products and to establish a professional platform for academic branding of collective expertise of potential commercial values. This project is aimed at creating and facilitating a single University platform to exchange knowledge and set outlines for future joint projects with external parties to the University. As on online platform it may outreach to different target groups or interested parties to partner with a team of combined academic expertise with assigned and contracted complex task. It has to be added that according the mentioned Report – of the Top-8 Bulgarian Universities – the University of Plovdiv is ranked 6th in terms of publication activity for the period 2010-2019 [1, p. 57, Table-3]. Institutional information of the University of Plovdiv demonstrate that most of the main publications are due to academic professionals from Life Sciences of the University of Plovdiv. Here is why, Vita Plus project is based on the main academic distinguished professionals in Life Sciences at the University of Plovdiv – to form a single team of transdisciplinary experts and reshape the mainstream of academic researches of the University. In particular, pivotal role at the Vita Plus project is played by the teams of Chemistry, and Biology experts, as they have extensive background on researching biotechnological problems.

METHODS

To explain the methods enhanced to investigate the specifics of the problem, it is reasonable to clarify some preconditions in the biotech R&Ds in Bulgarian economy. Historically speaking, biotechnological R&Ds date back as early as 80s in Bulgaria, but during political changes in the 90s the ruling Governments privatized all state-owned enterprises and restructured all supply-chains in the sector. The country lost much of its biotech production capacity, and all of its markets internationally. This was the reason to cut numerous jobs in the sector, to minimize business levels of activity in the sector, and to fragment the sector into numerous Small- and Medium-sized enterprises /SMEs/ with less to none market power, market shares, and market

competitiveness. Also, much of the qualified graduated individuals in biotech majors had to switch jobs or migrate abroad for good. This economic backlash diminished significantly Bulgarian production capacity in biotech enterprises for almost 30 years of economic transition to market economy and minimized dramatically University R&Ds in biotechnologies. It was recently, when some Bulgarian SMEs started to invest in biotech equipment, search for biotech graduates and look for opportunities to cooperate with researchers in this field.

Hence, the purpose of the applied research methodology is to test the hypothesis that technological transfer and innovation in the field of biotechnology can significantly improve international performance indicators of Bulgarian bio-based enterprises. As the study deals mainly with a literature review of current advancements in the biotech sector, the methodology utilized includes research methods for descriptiveness, but also for analysis and drawing adequate conclusions. In this sense, the research tasks related to the present analysis are defined as it follows:

- 1) to make some theoretical proposals for increasing the innovation potential of biotechnological enterprises in Bulgaria on the basis of the specific features of technology transfer options within Universities and publicly funded R&D Centers;
- 2) to present in a systematic way a concept for development of bioeconomy in Bulgaria, on the basis of establishment of a direct connection between enterprises and University R&D Centers.

It is reasonable to acknowledge that Bulgarian biotechnological industry started to revitalize, since Bulgaria's accession to EU with the assistance of European structural funds. For the two programming periods: 2007-2013 and 2014-2020, there were set some biotech enterprises, which started to focus on bio-based productions and orient their business policies towards cooperation with R&D sectors. However, the average hourly wage of individuals in the Bulgarian public R&D sector are about € 8 (2019), according to the mentioned World Bank Report, while the average value in EU is € 29, and in Germany – € 37 [1, p. 94, Figure 71]. Although, this may be statistically correct, but it has to be stressed-out that significant share of Bulgarian research projects does not include monetary compensations for researchers or they are inadequately small, in reference to the average values of compensations for similar projects in the industry. Thus, there are virtually small monetary incentives, at present to do commercially interested R&Ds fit for tech transfers, particularly in advanced fields, such as biotechnology. This is especially indicative for researchers in smaller enterprises, which have limited financial and logistical opportunities for large-scale innovations. Handling the facts and figures of reality in the Vita Plus project, it is discouraging not only for the “average scientists”, but particularly for “the young scientists” to pursue academic career with motivation. Rather, it is discouraging, and demotivating to do a “scientific project”. Although these facts, there is a positive trend charted between 2015 and 2018, that publication activity increased and it is comparable, according to the very same indicator for countries, such as Poland, Slovakia, Croatia, and Romania. The data are illustrated at **Figure 1**.

RESULTS

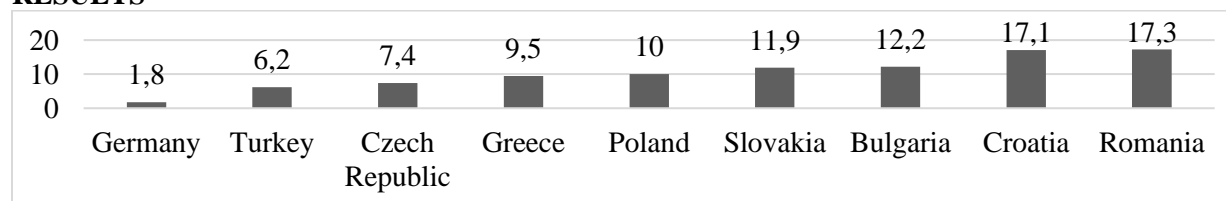


Figure 1. Number of scientific publications in Bulgaria compared to the level of gross expenditures on R&D, 2018 (Publications per million GERD)
Source: [1, p. 53, Figure 35]; GERD – Gross Domestic Expenditures on R&D

In contrast to Bulgarian reality, in the foreign academic literature there are different definitions of the nature of technology transfer. According to some definitions, it is defined as the process of moving technology from one organization to another [2], and according to others – transfer is a process of putting information into use [3]. Third authors define it as a process of applying technological principles to solve practical problems [4]. A much more practical orientation of the movement of ideas, technologies and knowledge is given by another definition, which defines technology transfer as the movement of information from one place to another, or from universities to enterprises [5].

In general, an innovation process is characterized by some specifics for each R&D Center in Bulgaria; hence, certain similarities may be found in individual progress stages of an invention, which allow to investigate thoroughly what exactly happens on each and every stage. In this regard, some authors propose a generalized innovation model, consisting of many activities and containing four successive phases: (1) study of internal and external environment, in which an enterprise operates; (2) selection of an innovation, based on the research done; (3) provision of resources for realization of the planned innovation; (4) practical development and implementation of the innovation [6].

In summation, the model is based entirely on the concept of an innovation process at enterprise level and the availability of analytical targeted information. In terms of importance for the development of the Bulgarian economy and its shift to bioeconomy, the last phase of the innovation process - practical development and implementation of innovation, is defined by other authors as “a process related to the dissemination of successful innovative practices in the processes and products of other enterprises” [7]. In other words, it is necessary, for successful implementation of an innovation process in the field of biotechnologies – to have “diffusion” (flow) of high quality information, which is very expensive by rule.

In particular, biotechnological innovations, which are deemed to set the foundations of the

forthcoming epoch of bioeconomy – are due to long-run, and heavily invested dynamic processes that include numerous sets of activities and professional teams, which are capable of materializing complex ideas into next generation high value added market products. In this sense, prevailing international practices demonstrate that fostering academic creativity, innovations and development activities do favor creation of successful University-induced tech transfers of advanced biotech intellectual products and technologies to business parties. And this international experiences and practices may be adopted in Bulgarian Universities and R&D Centers. Although, having lagged behind for some decades, this happens to be nowadays the course of transformation of Bulgarian publicly funded R&D Centers and Universities. These structures started to slowly transform into a significant link in the industrial-market supply chain, where commercial effects of biotech innovations are welcomed.

Taking into consideration all these recent trends, facts, and figures, it is worth stating that the Centre of Technologies at the University of Plovdiv is deemed to comply to this nationwide shift towards advanced R&D processes and supply high class intellectual products and technologies to interested private parties. However, it is the lack of roadmap to comfort biomedical inventions and product creation on purely scientific basis, stationed onto combined expertise of Life Sciences researchers at the University of Plovdiv. This roadmap shall be devised stepwise by intensive contribution of transdisciplinary expertise, accrued into unified project activities, such as the Vita Plus Project.

Although it seems as theoretical easiness, adequate commercializing of intellectual products there is insignificant to non-existing structured approach or defined pipeline of activities to bring an end-result, ready to market. This is particularly complex, when it comes to regulated products such as drugs – any kind of biological molecules and devices, per se.

It has to be added that inventions and processes in biotechnologies are collective-work technologies, which may be produced only in a

well-functioning structure of clearly defined financing and commitment policies of stakeholders, including financially motivated researchers. Otherwise, without having strict contracts coupled with result milestones and regular payments on deliverables throughout the contracted period, there shall be brain-drain of educated professionals and unpredictable knowledge spills.

The Vita Plus project is deemed to test synchronizing collective expertise and shifting towards agreed scientific tempo between the University as a stakeholder, and researchers – as brain-powers driving the invention process forward. Consequently, pragmatically speaking a systematic approach of transdisciplinary expert organization necessitates good-will and acceptance of the following five elements, synchronized into a uniformed series of achievements:

- Agreed roadmap between the University as an institutional stakeholder (providing R&D superior assets and equipment and adequate working environment, adjusted to EU standards) and the researchers (which may be both internal and external for achievement of an R&D goal);
- Legal contractual basis for fair ongoing remuneration and royalties after selling the intellectual products to third parties (including formal confidentiality agreements);
- Business-oriented approach and expertise to search for EU and international financing, which makes the international collaboration, international meetings, and international negotiations imperative for successful biotech R&D processes;
- R&D program goals – agreed by all stakeholders and participants to achieve;
- Regular reporting methods, including progress reports on financing of the process and milestone achieved;

Despite the indisputable link between technology transfer and knowledge, ideas and innovations, there should be no sign of equality between them and they should not be seen as a whole in the context of the innovation process. The leading argument in support of the above is the different

content and goals that distinguish the two concepts. According to some opinions, there is undoubtedly a close connection between them, but knowledge has very specific characteristics - to be non-coding, coding and training, which can not be fully said about the hallmarks of technology transfer [8, 9].

CONCLUSION

Based on the presented review of theoretical stipulations and practical considerations, some conclusions of the specifics in implementation of international practices of tech transfers of biotechnological innovations may be drawn. Firstly, innovation development shall be considered as an integral part of the process of biodiversity development. Biotechnological R&Ds are an enormous potential field, which may be applied to different industries, such as agro-biotech industry, healthcare sector, cosmetics industry, biofuels industry, biomaterials and biopolymers industries, and numerous others. Therefore, a research structure, shall be stationed at a certain topical research field and accumulate knowledge for commercial industrialization into a specialized industry. Secondly, innovation development is based on the exchange of information, and the main function of “engines” of development of transfer are the University R&D Centers in EU, USA and developed countries. These structures are leading not only for the huge investments in modern campuses and cutting-edge equipment, but also for building strong business and financial partnerships with interested private parties, cluster structures, technology parks, and other economically viable structures to drive R&D investments forwards. And thirdly, there shall be employed modern tools for intrinsic professional management of such technological centers, where the institutional legacy of the past performed academic administration is already obsolete. Inherited institutional norms of intrinsic institutional nominations and voting procedures, choreographed by some faculties and staff – bring in general no further professional competences and compromised economic value in managerial levels of the academic institutions; and respectively, strong professional reputation problems arise, when either business-oriented professional capacity issues, or confidentiality

questions are brought to the table of discussions. Henceforth, the missing chains at this point in building successful tech centers in Bulgaria to transfer technologies are considered to be: strong economic reasoning to partner with private businesses, intrinsic/institutional managerial proficiency, structured approach to R&Ds to deliver end-results of practical business value, legal expertise in tech transfer procedures, and access to EU and international financial funds and expert forums.

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