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MULTI-LEVEL DIGITAL INTERACTIVE EDUCATION-TRAINING PLATFORM FOR TRANSBORDER INNOVATION-ORIENTED CO-DEVELOPMENT

Abstract – based on analysis of modern tendencies in educational sphere and innovation experience; a new model of “triple integration” for Innovation eLearning is presented and a transborder multi-level digital educational-training platform for its realization as well. This proposal is integrated in framework of the Ukrainian-Slovak International Center for Innovations and technology transfer and may be used as a base for joint R&D and for development of the pilot project for innovative education and educational innovation.

Keywords: *E – Learning, interactive education-training technologies, digital platform, innovation system, transborder innovation-oriented co-development*

I. Introduction

Having completed the first decade of the 21st century by the global financial and economic crisis and entering the current decade, the world community at the UN level has identified the need to provide fundamentally new foundations for ensuring the sustainability of its evolutionary dynamics. In turn, this led to the awareness of the need for a planetary transition from a financially-driven industrial economy to a new type of economic globalization oriented towards innovation as an interdependent co-development on a new institutional basis. Thus, such a transition simultaneously involves a change in the very model of development, from the exclusive to the inclusive one. In addition,

it is an appropriate replacement of its leading entity, which now serves as a globally integrated, self-sufficient economic region [1] .

Since now focusing on sustained inclusive development on an innovative basis is a priority focus, it forms an urgent request for modern knowledge not only in regard to new objects, but also, more importantly, about new participants, such as innovation – oriented regions, their institutional architecture and innovative infrastructure capable of providing an effective interactive cooperation of the regional economy with all levels of national, transnational and global one. As a result, national education systems, first and foremost, institutions of higher education face the global challenges of their ability to provide the economy and society with modern knowledge, skills, experience and competences necessary for innovative, inclusive development.

The current knowledge spectrum was formed as a consequence of system changes in public demand that took place over the past 50 years. Thus, since the 1980s, there has been a steady and deep decline in demand for routine stationery and engineering and information competencies that can easily replace by computers. Although with different historical dynamics, but since the 60s, the global recession has demonstrated demand for both traditional (routine) and non-traditional manual labor, which is increasingly carried out by machines. Instead, throughout this period (with a certain intensification after 2000), the demand for a high level of analytics, which requires deep special knowledge, abstract thinking and the ability to search for original solutions, steadily grows. However, the prevailing dynamics demonstrates a constant tendency to increase the demand for specialists capable of designing and managing long, dynamic, and interactive chains of high added value based on relevant information and communication networks [2]

In this case, it is not just said about direct communication between firms that forms the basis of trade, direct investment and inter-corporate alliances, but also include interpersonal ties, which often becomes more efficient, especially in the case of transfer of knowledge and technologies between countries with significantly different levels of development [3] Highly skilled migrants who form the entire transnational community [4] and become “new argonauts” of global network manufacturing [5] are usually the active participants of such transfer of the “brain circulation” and configurator managers of this phenomenon. Such communities generally contribute to the globalization of the movement not only of people and knowledge, but also facilitate innovation of technologies and venture capital [6].

Of course, such complication of the processes of generation and translation of new knowledge requires serious corrections, first of all, in the system of higher education. These corrections would be responsible for increasing efficiency, improving quality and reducing inequality in gaining modern knowledge [7]. Traditionally, the higher school is responsible for the fundamental and “routine” knowledge, which is usually limited to the natural and technical and socio-humanitarian spheres and subject areas of disciplines, on the basis of which the graduate specialty is formed. For a long time such approach was in

line with the economic and social needs of society. However, today, modern times require highly dynamic, innovative knowledge of interdisciplinary, as well as transdisciplinary type, and needs in new competencies that require skills of creative and critical thinking, the ability to model business behavior of economic actors and stimulate their innovation-oriented corporate motivation [8].

Such tendencies encourage the scientific and educational sphere to transform in the direction of integration with innovative business activities through formation of innovative institutions – like business incubators university scientific and academic technological parks. From other side an innovation business have to go beyond the traditional corporate forms of transfer of advanced knowledge and their diffusion through the development of information and communication, organizational and institutional networks[9]. The development of this counter-institutionalized and substantially heterogeneous movement, in turn, requires strategic coordination and appropriate coordinators. Coordinators are represented by various non-market institutions such as public and sectoral associations, non-government and government promotional agencies, independent research centers and foundations, etc. [10]. At the same time, the rapidly growing number of “players” in such potential innovation and educational market forms an urgent request on new quality, of their business activity. In turn, it needs in appropriate innovation in education and the formation of entrepreneurial competences for graduates, as well as increasing the scientific and educational provision of innovation and interactive interaction with higher education in the training of innovative entrepreneurs. However, a significant obstacle on the way to the market-based solution to this problem consist in the large number of barriers that arise in the face of such a counter-movement, primarily between the public education sector and private business [11].

In this connection, the construction of a multilevel platform-interface, which should provide not only an interactive cross-sectoral interaction of various kinds of “innovative players” in such heterogeneous polysubject environment, but also supply integration of their activity into strategic co-ordinated inclusive development, becomes very actual. In turn, because such innovation-oriented development under the conditions of “new globalization” is possible only as a co-development, the pilot development of transborder interface, the initiative proposal of which is a practical part of this article, is of particular importance.

II. Theoretical-model grounding

The above-mentioned tendencies, of course, interactively reflect those fundamental changes that take place in the very nature of global economic dynamics. In general, these changes are illustrated in Figure 1

From the historical point of view, this picture shows those “evolutionary steps” that the world economy has consistently passed (of course, in its nationally diversified format), evolving from resource-ori-

ented (agriculture and mineral extraction and industrial processing) of through structurally-organized industrialization (agrarian and industrial economics) to post-industrial types of based on, institutional-oriented economic reality (innovative and cultural-creative economy). In its entirety, this whole “economic ensemble” can only be seen in such large countries with “late industrialization” as China, but fragments of all previous stages of the formation of the global economy are integrated into national economy of any industrially developed country. From a principle point of view, it is important to note here that the role of at each evolutionary stages, main driver of economic growth were played by different forms of capital:; the productive – in the resource types of the economy, industrial and innovative – are inherent in the early and “mature” industrialization, humanitarian becomes an accelerator for innovative economy, as well as institutional for – cultural and creative.

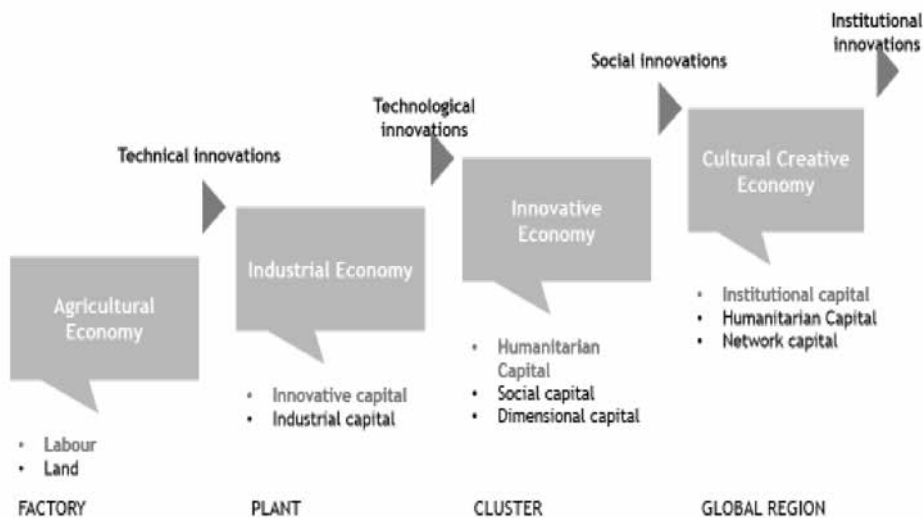


Figure 1. Economic development path

Each of these factors has its own institutional architecture, mode of generating, concentrating and transferring knowledge and leading innovations. Thus, innovation capital owes for its growth to the introduction of – technological innovations, humanitarian – social, and institutional – creative institutional ones. From a theoretical point of view, such a picture basically corresponds to the 5-factor model of endogenous growth, which may be represented in factorized form as the functional [12]:

$$Y = F (L,K,A,H,I) \tag{1}$$

Here Y is a production function, and L, K, A, H, I, is industrial, innovative, humanitarian and institutional capital, respectively, usually L and K are concentrated in classical localized form which is typ-

ical for classical trade and industrial firm, while innovative capital has multilocation, structure as in case of MNC ,humanitarian capital already has non-classical spatially distributed form of clusters and agglomerations, and an institutional – but institutional capital has complicated construction integrating its hard, soft and virtual parts. This last post non – classical virtual part opens the perspective for development of a global network with a cultural and creative hub in its epicenter.

According to such changes, the post-industrial stage gives rise to, fundamentally new generators, translators and users of innovative knowledge appear – from innovative business incubators, scientific, technological and industrial parks, high-tech clusters , territories and zones of economic and technological development, global cities and regions. Based on this new institutional foundation there may being buitt a moder powerful “engines” of innovative development far new economic regions, whose principal form is presented in fig 2.

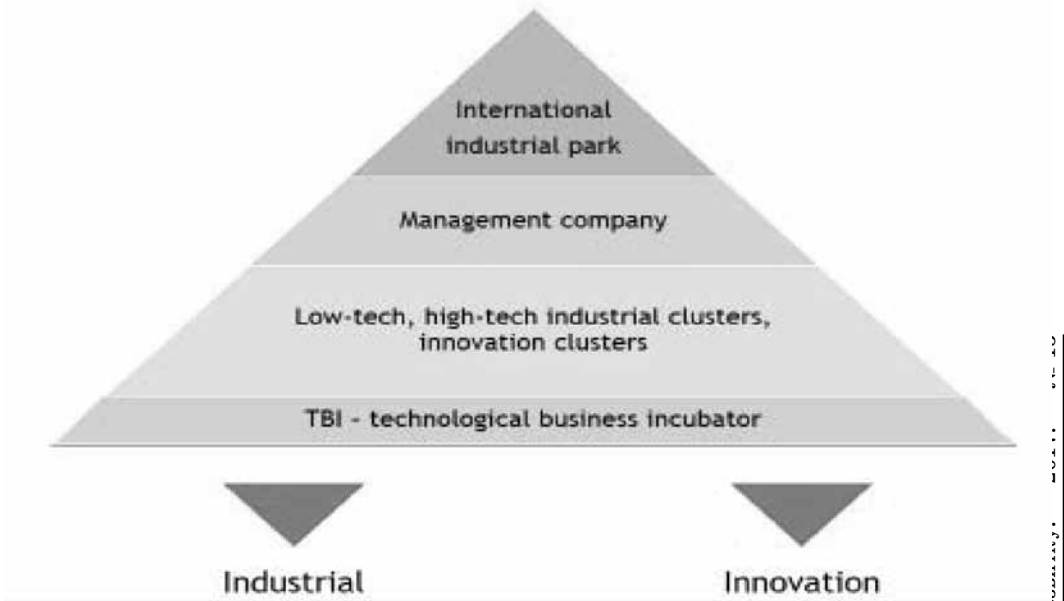


Figure 2. Institutional structure of the nucleus of the innovation ecosystem.

TBI – technological business incubators; STIP – scientific, technological and industrial parks; IIP is an international industrial park

Here TBI is responsible for startup incubation based on technological innovations and for generation of new knowledge, STIP provides with design of new products and the development of industrial technologies for their further production in clustered “chains”, which are obliged for industrialization and commercialization of innovations. In turn, the success of such industrialization and commercialization also requires a codified form for new knowledge – in form of innovative educational tools. The rapid increase in the number of such tools provides a reason to talk about the emergence of a new and rapidly growing industry of educational resources (developing educational tool of

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industry) [11, p.134] Of course, support for such growth requires both the continuous circulation of innovative educational tools within this spatially-distributed network industry and its effective interactive communication with traditional institutes of the scientific and educational sphere.

Such circulation and communication is the only for” innovating education” and “educating” innovation. However lack of acceptable vertical integration between different levels of this activity, which reduces opportunities of small innovative firms – is a serious obstacle for the circulation of new educational tools in innovation sphere. On the other hand, there are quite a lot of serious barriers to establishing effective communication between the innovation industry and the traditional education system, as [13]

- lack of investment for innovation in traditional education;
- oligopolistic domination in the field of education of several large educational institutions (“Big Edu”), which cannot compete with small producers of innovative knowledge in a specific market of educational services;
- weak (due to the participation of a large number of participants and various intermediaries, including with state agencies and local administrations) organization of sales of innovative means in the public sector of education;
- the weakness of the technical base for testing of innovative means;
- insufficient level of advanced knowledge and business culture and weak expert function in the management of public education which is responsible for the purchase of innovative means;
- low level of communication between the public education sector and producers of innovative educational tools;
- a limited economic scale and a long cycle of private innovative educational production in the public sector that does not generate sufficient motivation for venture capital.

Besides, it should be mentioned a lot of other fundamental defects inherent in public education, which restrain the modern innovative development of countries and regions, in particular:

- low level of integration between higher, vocational and secondary education, which limits the realm of the practical competence of a future specialist, and at the same time removes its innovative and creative potential (for example, the training of a machine operator with digital software control (DSC), except for the knowledge of operations requires yet interactive communication with programmers and technologists, and this is already a field of higher education school);
- weak link of public education with innovation industry, as well as educational theoretical programs with practice of innovation, lack of training tools for innovative entrepreneurs;
- insufficient interconnection and mutual influence of innovative, and therefore, public educational activities, with regional development programs and strategies.

Of course, the need for sustainable, institutionalized, inclusive innovation – driven development requires appropriate programs, strategies and systems with high efficiency. As a system, it should cover and

harmonize interactive activities and market behavior of all its actors and participants. The first practical forward in this direction could be done by development of a multi-level interactive educational and training platform in trans-boundary version.

III. Project proposal

Favorable conditions for such proposal are being formed within the framework of the project of the Ukrainian-Slovak International Center for Innovations and Technology Transfer, based on the Memorandum signed on March 20, 2017 between the National Science-Technological Association of Ukraine, Uzhhorod National University and the Technical University in Kosice, as well as their science parks. On June 30, the parties agreed on the conceptual and institutional basis for this Center, similar to the one presented in Figure 2, as well as the road map and practical steps for its implementation.

The main objective of the Center is to develop the international infrastructure for designing, investing, configuring and managing to cross-border and transnational clusters and networks for industrialization of innovations in the priority directions of joint activity. Of course, the basal level of this activity is oriented on intensive and interactive exchange of innovative knowledge, ideas, technologies and competencies. However, the effectiveness of this interchange activity critically dependent on the ability of such an infrastructure to overcome successfully both the aforementioned and new cross-border barriers. In turn, it needs in new institutional mechanisms and modern innovation platforms. One of such new institutions, focused on concentration and generation of innovative educational tools, as well as formation of the necessary competences for cross-industrialization of industrialization, could be proposed in form of the International High School of Innovation Entrepreneurship.

The fundamental reason for this proposal consist in is the complex nature of modern knowledge and the multidimensionality of cognitive space. On the one hand, this space is rather universal and does not depend on the specific context codified as general knowledge (knowledge – K), special knowledge (expertise – E), as well as skills – S and experience(– e). General and professional knowledge (K & E) form the educational basis, while specific (S & e) – knowledge are responsible for global competitive advantages within the framework of the post-industrial knowledge-based theory of the firm [13] . At the same time, the new knowledge generated by small innovative firms which, contains an original, “hidden” part of the civilization-cultural context generally dependent on the “tacit knowledge” (T[14], as well as its contextual component (contextual knowledge-C) [15]. This “tacit” and contextual (T & C) knowledge serves as the source of own original and creative, innovations.

However, in order to become the emerging industry for new educational tools, innovative firms have to create a collective cognitive field

as well as a favorable reflexive and active environment, which will the initiative and creativity of everyone. It means that success of this process is critically dependent on collective K & E, as well as on S & e-competencies in the areas of:

- team building [16] and development of creative potential of the firm [17];
- effective implementation of the common cognitive function [18] and the ability to distinguish and “extract” from local T & C networks, codify and broadcast new knowledge within corporate network [19];
- supporting entrepreneurial passion [20] and promoting globalization (G) for business initiatives to build new G & S & e-knowledge within the framework of such a “global-learning scenario” [21];
- accelerated growth of social and human capital based on dynamically increasing potential of G & S & e – knowledge and capabilities of corporate networks [22] .

Such a differentiation of knowledge by their nature and mode of generation, depending on the “collective subjectivity” and the cognitive potential of the management team of the firm, substantiates the need to form a separate subject field which may be called as – innovation entrepreneurship. At the same time, its needs in creation of the appropriate institute – the Higher School of Innovative Entrepreneurship (HSIE).

The idea of the HSIE reminds us the historic precedent of the creation of business schools mm on mature stage of industrialization ,that combine university education and entrepreneurial activity. Specialized master’s programs created in this integration, oriented mainly within the framework of the subject field of “International Business” as well as on theories and strategies of the firm. But transition to post-industrial types of the economy (innovative and cultural-creative), as well as the replacement of exclusive model of development on inclusive one, required the introduction of the subject “International business” as the newest educational field of knowledge [23]. Unlike the “International Business”, where a localized (or multi-local) firm acts as the basic entity, there is a subject-oriented transition to the study of innovation as a manifestation of entrepreneurial spirit. This spirit is the source of creative innovation, including technological, social and institutional ones.

Really, the social and institutional innovations are responsible for organization and self-organization of spatially distributed polysubject and multicultural reflexive-active environments. Therefore, they require in-depth knowledge of the nature, design, investment and strategic management for these complex systems (scientific, technological and industrial business incubators and parks, clusters, agglomerations, special economic zones and other innovative territorial entities).

In turn, such transformation needs in for the professionalization of this kind of knowledge and competencies from the point of view of global challenges, rebelled against the evolutionary economic dynamics of the planet. First of all, there are concentrate actual request for three categories of innovative top-specialists:

- top managers for innovation-oriented territorial entities (including innovative business incubators parks and zones, clusters and agglomerations, cities and regions);

- top management of innovative teams, firms and other institutions;
- deputy heads of regional administrations and local self-government bodies responsible for strategic (innovative) development issues.

Thus, the HSIE would promote the integration of traditional education and science with innovative educational and business activities. In addition, it would create the necessary conditions for the integration of innovative ecosystems with the system of institutional planning and strategic management of sustainable inclusive development for both new regions and traditional territories.

In the format of the International School, starting with the development and launch of a common eLearning platform, this would form a single communicative space of understanding that would also take into account the diversity of T & C knowledge and top management competencies. Without such an understanding, it is difficult to rely on effective cross-border innovation-oriented interaction.

On the other hand, a common network of competencies tools with unified qualification requirements and standards is needed to form a common E & S & e-knowledge space. Indisputably, first and foremost it may be done in the form of appropriate cross-border eLearning platform. However, for the practice-oriented integration of such professionally oriented E & S knowledge, it is necessary to overcome three types of previously identified barriers: institutional, structural and functional fragmentation of the sphere of education, separation of this sphere from the innovation industry and the lack of effective coordination between innovation ecosystem and regional development. How to overcome these obstacles becomes clear from the model of “triple integration” is shown in fig 3.

There are presented three integrated by own local IT platform parts including digital eLearning & training center, prototype center and regional innovation development system. The first part based on center of excellence and qualification system integrates advanced opportunities of higher, senior secondary and technical schools.

As a joint pilot project of transborder system for educating and training adapted to EU requirements and standards specialists this center may be located in Uzhgorod and Kyiv cities on ukrainian side. Taking into account the actual demand from V4-countries, especially from automotive cluster in Slovakia, such collaboration could be started from training for broad spectrum of mechanical engineering specialists, including operators of DSC machine-tools, programmers, designers, technologists, etc. Basic model of such eLearning training center is shown in fig. 4.

Presented in fig. 4 model has three educational (basics, middle and top) levels based on small machine-tools interactive modules and e-simulators. The basic level is responsible for training to operators of DSC machine-tools, while the middle one supplies not only future operators, but also designers and programmers with more complicated training, as well as the top level is obliged for training to technologists, system integrators and administrators, chief engineers and technical directors, etc. In case of equipping such center with robots and 3D print machines it transform into full format innovation educational-training eHub.

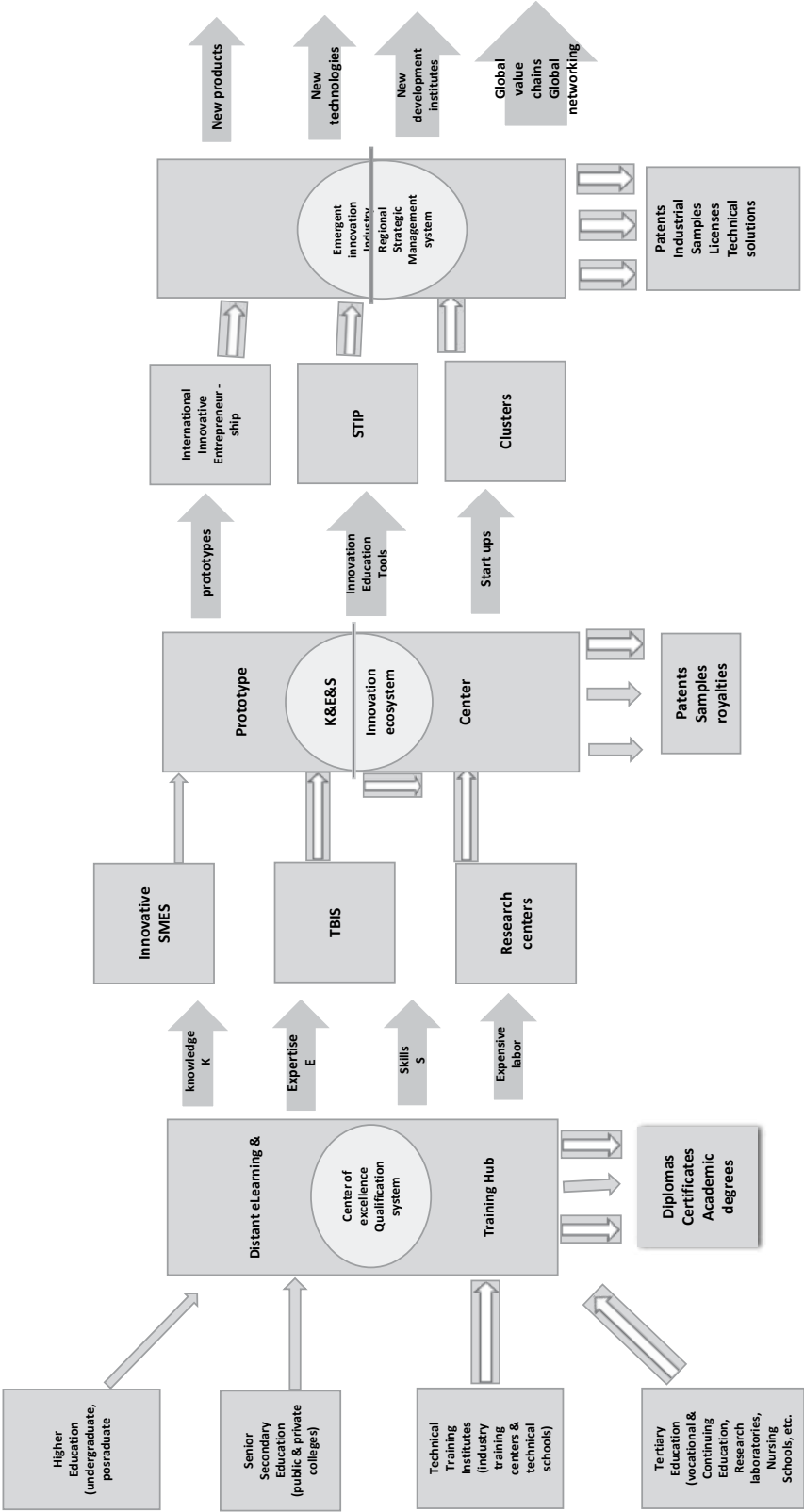


Fig. 3 The model of «triple integration» e-Learning innovation education platform

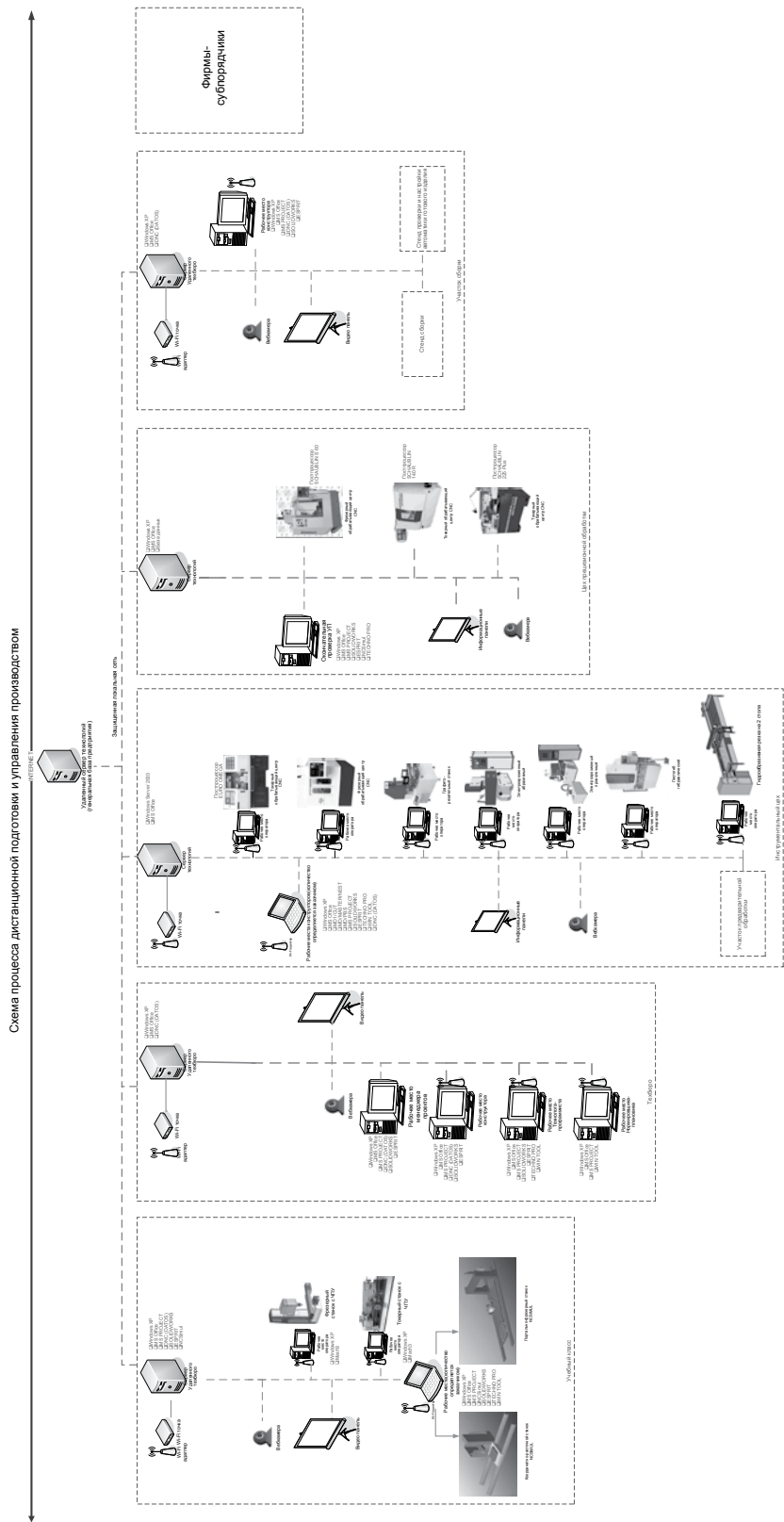


Fig. 4 Local interactive eLearning center for training mechanical engineering specialists

The second part of the presented in fig. 3 platform is responsible for integration of such eLearning & training center with basics innovation activity, prototyping and startups incubation, while the third part is obliged for integration of this activity into regional innovation development system. Thus, presented there platform as an transborder innovation-oriented interface serves as the base for further multilevel integration in framework of appropriate super platform, as it is shown in fig. 5.

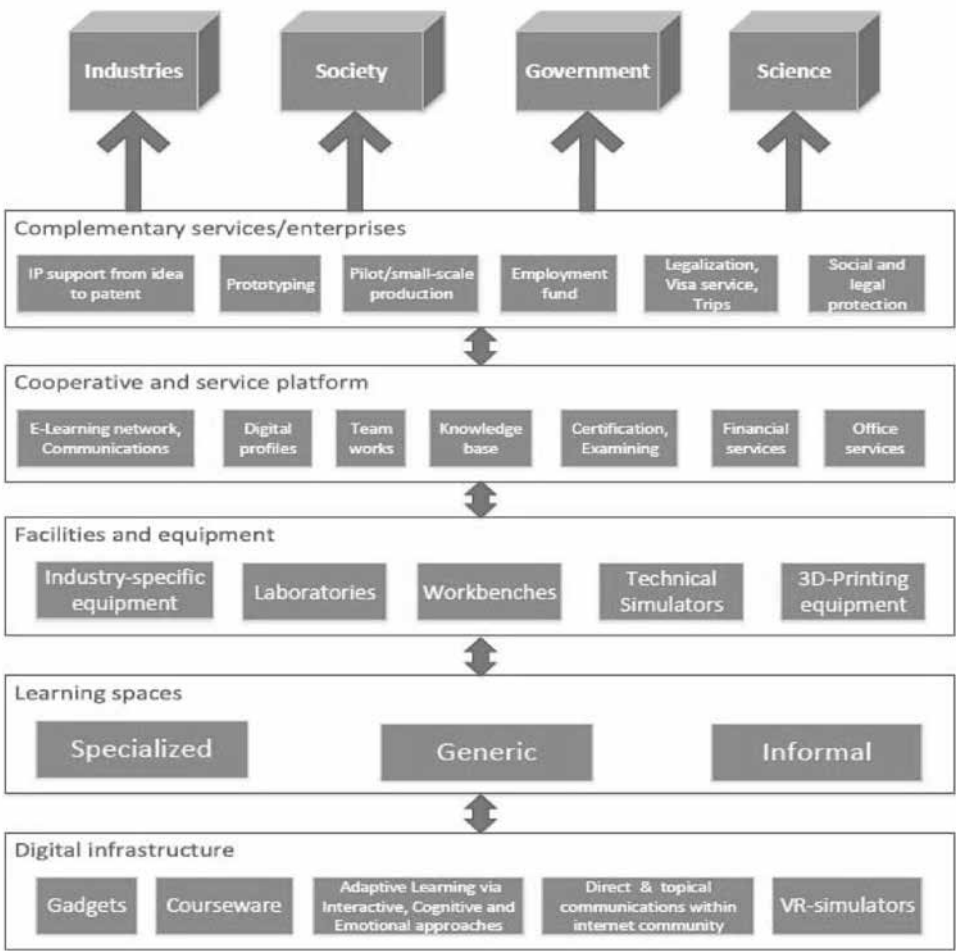


Fig. 5. Transnorder multi-level digital interactive e-Learning service platform

There is presented technical order on the server and software solution for the transborder multi-level digital interactive education-training platform which integrates all above mentioned sub platforms. As a joint transborder project such platform will promote to innovation-oriented co-development of each country and region-participant.

IV. Conclusion

Sustainable development goals and global transition from actual financially-driven exclusive model of mainly industrial development to the Innovation-based Inclusive one needs in new, non-classical types of advanced knowledge, trans-disciplinary expertise, duly, modern competencies and experience (K&E&S&C&e). Such complex K&E&S&C&e – set is dispersed among a lot of institutions and tools, both traditional and innovation ones. It gives rise to understanding of necessity in creation of joint integration IT-platform at least. This platform will be served as a bridge between traditional education sphere and emergent industry of innovation educational tools. This way opens a realistic mechanism for innovating education and educating innovation on K&E&S&e – base.

From another side, innovation activity needs in integration into regional systems of sustainable inclusive development and in training of modern competencies and multi-level professional skills and experience as well. A sound foundation for such solution gives us the presented new model of a “tripled integration” for innovation eLearning.

In framework of this model there were proposed two new types of innovation institutions – Higher School of Innovational Entrepreneurship and local interactive educational-training centers for adequate E&S&C&e – set.

As a general result and project proposal for joint R&D activity there is presented a transborder multi-level digital interactive educational-training platform for innovation- oriented co-development. This platform may be easy integrated as an important part of the Ukraine-Slovak International Center for innovations and technology transfer, as it was reported and discussed at the 15th International conference on Emerging e-Learning Technologies and Applications in Stry Smokovec, The High Tatras in Slovakia , October 26-27, 2017[24]

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Багаторівнева цифрова інтерактивна освітньо-тренінгова платформа для транскордонного інноваційно орієнтованого співрозвитку

Анотація. На основі аналізу сучасних тенденцій в освітній та інноваційній сферах діяльності обґрунтована та презентована нова модель «потрійної інтеграції», а також транскордонна багаторівнева цифрова освітньо-тренінгова платформа для її реалізації. Цей підхід розроблений в рамках розвитку Українсько-Словацького міжнародного центру інновацій та трансферу технологій, а запропонована модель може розглядатись в якості основи для спільних науково-дослідних робіт та реалізації транскордонного пілотного проекту з інноватизації освіти і поширення сучасної освіти в сфері інноваційної бізнес-діяльності.

Ключові слова: електронне навчання, інтерактивні освітньо-тренінгові технології, інноваційна система, транскордонний інноваційно орієнтований співрозвиток.

Многоуровневая цифровая интерактивная образовательно-тренинговая платформа для трансграничного инновационно ориентированного соразвития

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Аннотация. На основе анализа современных тенденций в образовательной и инновационной сферах деятельности обоснована и представлена новая модель «тройной интеграции», а также трансграничная многоуровневая цифровая образовательно-тренинговая платформа для ее реализации. Данный подход разработан в рамках развития Украинско-Словацкого международного центра инноваций и трансфера технологий, а предложенная модель может рассматриваться в качестве основы для совместных научно-исследовательских работ и реализации трансграничного пилотного проекта по инноватизации образования и распространения современного образования в сфере инновационной бизнес-деятельности.

Ключевые слова: электронное обучение, интерактивные образовательно-тренинговые технологии, инновационная система, трансграничное инновационно ориентированное соразвитие.