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Education Excellence and Innovation Management:
A 2025 Vision to Sustain Economic Development during Global Challenges

Editor

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The “Knowledge Triangle” Is A Modern Concept for Managing the Development of Education, Science and Innovation

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Abstract

The purpose of the research is to consider the modern concept of the “Knowledge Triangle” as a universal approach to higher education for the development of innovative economies of states. The theoretical and methodological base of the research is constituted by the fundamental principles of economic theory and practice, general scientific and special methods of knowing economic reality. The main methods that were used: structural-logical; comparative, the method of detailing and synthesis. The concept of the “Knowledge Triangle” is becoming a more popular method for regulating innovation and developing state innovation policy. The article provides a conceptual analysis of various definitions of the concept and its relationships with other structures, in particular with national innovation systems. The basic elements of the concept and the possibilities of its application in the development of innovative policy of state innovation policy the state are considered. Attention is focused on a systematic approach to regulating the processes of creating scientific knowledge and innovation. The participants in the “Knowledge Triangle” are described, which include higher educational institutions, authorities and private companies. Their tasks in the development of state innovation activity are determined. It is concluded that universities perform numerous functions; therefore their functions are usually determined by the national context. The quality of educational, scientific and innovative activities of universities varies from country to country and depends on historical factors, public policy and institutional structures.

Keywords: higher education, university, science, innovation.

Introduction

The concept of the “Knowledge Triangle” formalizes the links between the traditional “basic” functions of universities – teaching, research and social activities. Under this model, universities, implementing educational programs and scientific projects, generate scientific knowledge, and multi-faceted interaction with the general public helps to create new products, processes and services.

Higher education and research systems in the public sector of developed countries are in the process of transformation. Long-term political reforms of higher education led to duplication of measures of educational, scientific and innovative policies, and sometimes to contradictions between them.

The feedback between education and the innovation sector remains poorly understood. Scientific knowledge sharing is limited to promoting individual innovations for educational purposes.

The concept of the “Knowledge Triangle” implies not only the strengthening of the educational, scientific and innovative components, but also the strengthening of the relationships between them. The concept can become an attractive basis for a policy whose task is to link the creation of scientific knowledge with innovative activity.

The theoretical basis of the “Knowledge Triangle”

The “Knowledge Triangle” is formed from the three functions of universities in educational, scientific and innovative activities. The quality, intensity and significance of each of the three activities are very different in the production of new scientific knowledge by country and region.

M. Unger and W. Polt (2017) discuss the functioning of the “Knowledge Triangle”, analyse the roles of its participants, their motivation to participate in this system and possible problems. An analysis of the cases revealed that in order to implement institutional transformations in universities and other organizations, certain incentive methods are required. These include federal or regional strategies with a targeted budget, competitive programs, special measures for the distribution of state grants, etc.

The various aspects of the “Knowledge Triangle” in OECD states can be found in the studies of M. Cervantes, which address issues related to improving the effectiveness of higher education and the growth of its socio-economic significance as the main element of the innovation system. The author's work of M. Cervantes (2017) reveals the content of the model, analyzes its promotion strategies, issues of evaluating the effectiveness of educational institutions, possible contradictions in relations with other subjects of scientific knowledge production. It is concluded that there is no universal model of universities and the “Knowledge Triangle”. The reason for this is the peculiarities of educational systems in different countries.

M. Raunio, N. Nordling, M. Kautonen and P. Rasanen (2018) suggest using a platform approach in which users create new value for each other, generating a network effect and a combination of digital solutions and physical innovation support centres. The authors consider this model as a source of answers to modern challenges in the development of the “Knowledge Triangle” strategies and regional development based on scientific knowledge.

The theoretical and methodological base of the research is constituted by the fundamental principles of economic theory and practice, general scientific and special methods of knowing economic reality. The main methods that were used: structural-logical (when constructing the logic and structure of the work); comparative (when considering the various participants of the “Knowledge Triangle”, concepts and models of innovative development and their analysis), the method of detailing and synthesis (to study the sources of financing science and innovation).

The purpose of the research is to consider the modern concept of the “Knowledge Triangle” as a universal approach to higher education for the development of innovative economies of states. To achieve the purpose of the research, the following tasks were set: to consider the prerequisites for the emergence of this concept; analyse the definition of the “Knowledge Triangle”; to identify the basic elements of the concept and the possibility of its application in the development of innovative policy of the state; to characterize the participants of the concept and determine their tasks in the development of innovative activity of the state; point out the special role of universities in shaping the contribution of education to science and the creation of innovations.

The “Knowledge Triangle” is a concept that involves an integrated approach to politics in the field of science, education and innovation with an emphasis on the role of universities as a subject of the production of scientific knowledge. The concept intersects with other models that focus on individual participants in the innovation system, namely the “third mission”, the “entrepreneurial university” and the “triple helix”, whose brief characteristics are reflected in fig. 1.

Having common properties, these concepts, however, have some differences. The “Knowledge Triangle” model focuses on activities in the educational, scientific and innovative fields, while the “triple helix” considers participants in the national innovation system. The concept is a functional model that characterizes two-way communication channels between the mentioned areas of activity.

The novelty of this concept lies in the focus on the role of education in the development of science and innovation. Thus, the “Knowledge Triangle” can be defined as a combination of participants in three areas (education, science, innovation), which expands the possibilities for joint activities (Fig. 2).



Fig. 1: Conceptual models of innovation system management

Source: (OECD, 2015), (Ranga and Etzkowitz, 2013), (Unger and Polt, 2017)

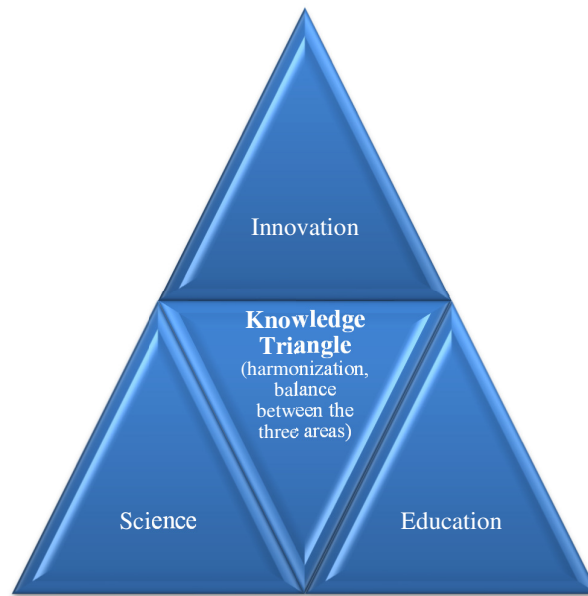


Fig. 2: The “Knowledge Triangle” of science, education and innovation

Source: (Unger and Polt, 2017)

This model, which belongs to the category of “systemic innovative concepts,” should not be considered as a full-fledged substitute for any of the other schemes described earlier. Some of them are already used in institutional practice, becoming part of the strategies of scientific, technological and innovation policies in a number of states.

Let us turn to a detailed examination of the activities of participants involved in the “Knowledge Triangle”, problems for politics in the formation of relationships between all its components, political approaches that favour or hinder the functioning of this system. This concept can be used as a political tool, socio-economic model or strategy for the development of academic institutions.

Higher Educational Institutions

Universities as the foundation of the “Knowledge Triangle” make the main contribution to the filling of all its components. Different types of institutions do not play the same role in different countries. Diversity is found even among institutions of the same category. We mention only some key aspects: topics of scientific and educational activities, resource base, organizational structure, internal management mechanisms and relations with other stakeholders. Depending on the degree of diversification of universities, increasing the effectiveness of their participation is ensured by flexible adjustment of political measures. Based on the policy of autonomy and increasing the responsibility of universities, many states are deliberately working to strengthen their image as socially significant institutions involved in the transfer of scientific knowledge.

Universities transfer and commercialize scientific knowledge using a variety of channels. Traditional core scientific knowledge channels include (Vonortas, 2017):

- Publication of articles, monographs, proceedings of conferences, reports;
- Communication in the framework of professional conferences, informal ties, working contacts;
- Research or consulting services for companies provided by universities and state scientific organizations;

- Hiring employees in the company and student internships, the institutional basis for which can be ensured by organizing an internship, joint scientific management of graduate students;
- Development of standards defining terminology, measurement and testing procedures, interfaces;
- The founding of companies by students and recent graduates with experience in scientific research (recently this channel has received increased attention).

Less traditional ways of disseminating scientific knowledge aimed at their commercialization include (channels of the second category):

- Collaborative research, research projects carried out and sometimes funded by universities and companies on a joint basis;
- Scientific and technological partnerships, such as the creation of formal alliances with a different number of participants, for example, research corporations; conclusion of long-term research agreements;
- Contract research conducted by order of companies to solve specific problems;
- Patenting and licensing are the main functions of technology transfer centres. They do not cause much interest among universities and companies, but enjoy the great attention of state bodies.

The transfer of scientific knowledge from universities and state scientific organizations has always been carried out. It is bidirectional and through the exchange of research results and business information provides mutually beneficial cooperation. Traditional methods of transferring scientific knowledge are still relevant.

The concepts of “entrepreneurial” and “civic” universities are based on an expanded understanding of the role of universities. Nevertheless, there are contradictions between these models, since the orientation toward entrepreneurship, modernization, and the pragmatic distribution of assets from the point of view of a commercial result may not correspond to public goals, which often seem unrealizable in the short term. However, with an innovative and flexible approach, the university is able to combine “entrepreneurial” and “socially-oriented” models, gaining additional benefits through the use of creative resources to develop new solutions.

As the main participants in the “Knowledge Triangle”, universities play an important role in its formation. Their positioning in this system is determined by managerial models and financing mechanisms. The activities of universities not only contribute to strengthening the position of the region in global competition for attracting companies, but also largely determine its social, demographic and cultural appearance. The attractiveness of the region for young educated people has a positive effect on the development of its infrastructure, including schools, kindergartens, and cultural events. In addition, universities stimulate economic growth in the regions.

Public Research Institutes

The global competition for scientific leadership and the continued disregard for basic research by the business have contributed to the fact that public research institutes have become hubs of research and development (R&D). They occupy an important place in the innovative systems of countries performing unique research for the commercial sector. They carry out research in specific areas or implement strategic projects. They operate in the field between state universities and business, carry out specialized applied research, and open up career opportunities for researchers from specific areas, sometimes going beyond the university environment and not always oriented to the market.

Private Companies

Business as a subject of the “Knowledge Triangle” is guided by other interests than state institutions and developers of innovation policy. Entering into partnership with state organizations, private companies proceed from commercial rather than public or political considerations. This interaction is carried out through different channels. Particular importance is attached to the mobility of specialists with varying degrees of training, which form the basis of the innovative potential of companies, as well as research conducted by state universities or research institutes that can be converted into

innovations (Jaffe, 1986; Karlsson and Andersson, 2005). The contribution of companies to the development of education and R&D depends on the method and degree of intensity of interaction with the public sector of science and universities.

State Authorities

State innovation policy has become networked and decentralized. Politicians consider universities as suppliers of competent specialists, subjects of national and regional innovation systems. Effective communication of scientific, educational and innovative activities is a key prerequisite for responding to social challenges. State stimulation of innovations in the “Knowledge Triangle” takes various forms: tax lending to companies, conclusion of contracts with universities for the implementation of targeted R&D, the organization of postgraduate programs and student internships, the promotion of university advisory services, often financed regional authorities. Being very heterogeneous, the functions of government and administrative structures do not lend themselves to a uniform classification.

The concept of “smart specialization” is related to the coordination of the regional participants. It serves as a key paradigm for the formation of subsystems combining various components of the “triangle” in order to achieve sustainable regional development based on scientific knowledge and innovations. (European Commission, 2012; OECD, 2014a,b). In many countries, regional or other administrative units (cities, municipalities) to one degree or another participate in the formation of scientific, technological and innovative policies. Mechanisms for coordinating scientific, technological and innovation policies vary depending on the constitutional status of regions in a given country.

University management models and their financing schemes vary depending on the distribution of power between the central and regional levels.

The “Knowledge Triangle” takes on various configurations depending on the composition of participants and the areas of responsibility of the authorities. Within its framework, state structures (ministries, regional and local administrations) perform the following main functions (Mazzucato, 2013):

- determine the legal and regulatory framework for scientific, educational and innovative activities in the public sector by delegating responsibilities to relevant bodies, as well as developing norms, standards and regulations for business;
- institutes of higher education, public and private sector R&D and innovative activity are provided with resources through financing, as well as indirect incentives (provision of tax benefits, etc.);
- support innovations by generating demand for them (innovation-oriented public procurement system);
- manage the needs for highly qualified personnel and the results of scientific and innovative activities;
- establish thematic or technological priorities that serve as a long-term guideline for the distribution of financing, planning the activities of the public and private sectors.

In an attempt to coordinate activities, public authorities face many challenges. Engaging universities in the region is not an easy task for politicians. Problems arise due to differences in their teaching and educational missions. In turn, management systems and financial obligations in relation to universities, innovation policy or regional development depend on the distribution of powers between the central and regional levels.

Such a complex set of factors can lead to contradictions in the application of stimulating mechanisms. Consequently, the ability of regional structures and mechanisms for planning and implementing innovative policies to ensure the integrity of the “Knowledge Triangle” varies.

Conclusions

Thus, the “Knowledge Triangle” is not the ultimate concept, but rather a guideline that stimulates productive interaction between the educational, scientific and business sectors. Political measures based on such an approach are designed to expand the academic culture of universities, encouraging them to focus not only on scientific excellence and teaching, but also on the development of innovation and the solution of socio-economic problems. The concept was formulated to address a number of tasks: stimulate innovation; strengthening the flow of private investment in R&D; overcoming difficulties in connection with the commercialization of R&D results.

The innovative activity of business is increasingly dependent on the scientific base of universities. The latter are also the main employers for researchers in countries and serve the interests of local and national economies.

In addition, they produce public goods – from the flow of scientific knowledge, the training of qualified specialists to the scientific support of decision-making processes, and products for private consumption, including business consulting services, patented inventions, and contract research.

At the same time, in the context of decentralized financing of higher education in many countries and competition for supporting scientific projects, universities are under tremendous pressure from the state and other stakeholders. In order to meet modern requirements and satisfy the request for inclusiveness and accessibility of higher education, they need reforms.

Enhancing the social and economic importance of universities is a key task of national policy, the solution of which requires new approaches. In this regard, the relevant departments of OECD countries have high hopes for the concept of the “Knowledge Triangle”, which offers tools to strengthen the links between the educational, scientific and innovative functions of universities.

Meanwhile, universities as participants are very diverse, have different missions and structure for innovation, determined by country specifics. Their various types are capable of contributing to the development of innovations, carrying out educational, scientific and other activities and collaborating with other entities.

Effective tools to support the transfer of scientific knowledge are innovative strategies adapted at the local level. The traditional concept of scientific knowledge production as a linear and sequential process is being replaced by a systematic approach to scientific, educational and innovative policies.

The logic of the concept focuses on the links between educational, scientific and innovative activities. In accordance with it, any policy measure that focuses on any of these areas automatically affects the rest. The concept includes only those measures, criteria and tools that integrate all three of its components. The “Knowledge Triangle” encompasses different levels of politics, from municipal to international. Its strategic interpretation depends on the orientation of the national or regional innovation system and approaches to the management of science, technology and innovation in a particular country.

Thus, the “Knowledge Triangle” provides support for political decision-making, showing that investments in one of its components produce positive effects not only for the other components, but also for the external context, including the modernization of the labour market, stimulating structural changes in the economy, and improving the quality of life. Therefore, it should not be perceived as a theoretical concept, but as a practical platform.

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