



University 3.0 as a Corporate Entity of Knowledge Economy: Models and Missions

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ABSTRACT

The University 3.0 is established in higher education systems in developed countries, performing social missions of education, research, and knowledge commercialization. The purpose of the article is the study of the University 3.0 as a corporate entity of knowledge economy. For this purpose the author discloses the content its fundamental social and economic missions and models in the context of social reality and management policy; gives examples of scientific studies of the University 3.0 challenges. Based on the analysis of social reality it is shown that strategic systems of social development conceptualizations – “New Public Management,” “Network Governance,” “Neo-Weberian State” - demonstrate basic transformations from which the University 3.0 takes its origin. The University 3.0 is built on the basis of interrelated models of network, creative, innovative and entrepreneurial universities. The University 3.0 is becoming the basis for global competitiveness of national economies and geopolitical alliances.

Keywords: University 3.0, Economy, Research, Commercialization, Knowledge

JEL Classifications: I22, I23, I24, I25

1. INTRODUCTION

In mid-XXth century, higher education was losing its elitist positions. The emergence of global economy, engineering and technology expansion, growth and economic importance of knowledge production transformed higher education into a mass phenomenon directly responsible for society development.

In 1940, about 15% of young people at the age of 18-21 were studied at colleges and universities in the USA; their number increased up to 40% by 1963, and in 1968 the fast-growing sector of public education covered about two-thirds of students studied at colleges and universities. In early 1940s, even chief executives in top US corporations rarely had a college degree, e.g., IBM company hired its first manager with higher education a year or two before the Second World War (Drucker, 2008. p. xviii). In 1958, the percentage of human resources engaged in the US knowledge industry with account its potential students was 42.8%, and reached 53.1% by 1970 (Machlup and Kronwinkler, 1975, p. 757, 759).

In Europe, mass higher professional education was established 20 years later. In 1960s, European universities covered only 4-5%

of a relevant age group; as of today - 40-50%. For example, by the end of 1990s, over 30% of young people at this age were studied at German and Britain universities. In early 1960s, one lecturer provided “services” to eight students, and 40 years later - to 21 students. Doubling the ratio from 9:1 to 17:1 occurred within the period from 1980 to 1999 (Greenaway and Haynes, 2003. p. 152, 153, 154). However, the number of students was growing faster compared to the number of lecturers. For example, in Germany, the number of students increased by 232% from 1975 to 1995, while the number of academic positions - only by 130% (Ferlie, 2009. p. 9).

The end of XXth century gave the evidence of changes in socioeconomic functions of a university. A rapidly growing area of economic activity arose near to its conventional educational and scientific missions. The new field of activities at the University covers: Technology development and transfer, commercialization of academia products and their entry into the market, creation of new businesses, management of intellectual property for profit-making.

After adoption of the Bayh-Dole Act-1980 in the USA, in a few years universities established more than 2000 companies (260th

jobs) engaged in commercialization of technologies. Before the Act all universities in the USA recorded only 250 patents per year; in 1982 their number was 1500, and in 2010-4500. In 1989-1990, universities received license sales revenue equal to \$82 millions and in 2009 - more than \$1,5 billions. In fact, the Bayh-Dole Act institutionalized the American entrepreneurial university model. A noticeable growth of enterprises founded by universities was observed in postwar years, especially by the Massachusetts Institute of Technologies and the Stanford University (Etzkowitz, 2008. p. 39, 107). Cole (2010) guesses that a major part of leading industries in the USA, perhaps more than 80%, is a result of discoveries in American universities. Today, the USA is moving from the model of such business incubators, as the Silicon Valley, towards a distributed partnership with a university at the forefront. Innovations and entrepreneurial efforts of students in the United States is a key factor of competitiveness among universities.

In early 2000s, universities in Europe played an important role in creation of a knowledge society, because they were at the cross-point of research, education and innovation. The concept of EC excellence networks is based on the idea of scientific environment integration in universities at the global level into network structures using strengths of their participants. At the European meeting in Hampton Court (2005), universities, along with research and developments, were mentioned as the basis of European competitiveness. For example, the Cambridge University transformed Cambridgeshire into an innovation cluster - it gave birth to ten companies with billion dollar income capitalization. In 2011, the White Paper issued by the British government on higher education stated that best universities in the world were extensively making deeper their relations with business. They were striving for maximum benefit from innovations and providing training for students at the level exceeding a general level on the labor market.

The social space of a current university is penetrating into areas of life related to the knowledge economy. A successful university presents oneself as a creative, networking, and business organization. The university model with these features is also referred to as the "University 3.0." The digit in its name refers to the number of university missions: University 1.0 - only educational mission, University 2.0 - education and research; University 3.0 - commercialization of knowledge is added to the last two missions. Lane (2013) associates the emergence of University 3.0 with evolution of multi-campus universities in the USA.

In this work the author makes own contribution to studies of University 3.0 challenges.

The purpose of this article is the analysis of University 3.0 as a driver of economic growth within the framework of the University 3.0 concept as a corporate entity of knowledge economy. For this purpose it is required to disclose the content of its fundamental social and economic missions and models in the context of social reality and management policy and to give examples of scientific development of University 3.0 issues.

2. METHODOLOGY

In terms of methodology the study is divided into two levels - context and model. The socioeconomic reality of a present-day higher education and strategic systems of conceptualizations of social development are analyzed at the first level, and these systems show general transformations of the university in the context of management policy. Methods of socioeconomic analysis of institutional systems development, cultural and historical epistemology, and axiology elements are used at this level as methodological tools. The description of University 3.0 is constructed at the second level as a set of interrelated models with key characteristics revealed at the context analysis stage. It uses methods of socioeconomic simulation of cross-institutional interaction and the theory of innovation processes, cultural and historical reconstruction, structural-functional analysis of institutional systems and social actions. A comparative analysis of source information is used throughout the study.

3. RESULTS

At the turn of 1970s and 1980s a considerable state-owned sector justified by a dominating concept of a Welfare State suffered a major setback under the influence of economic constraints and political solutions. The government requested universities to ensure economic efficiency with account of labor market demands. The government was introducing strategic planning in universities, auditing, and assessments based on performance indicators.

Meanwhile, institutional collaboration between universities was extending. Universities were involved in the EC framework programmes on research and technology developments (1984), in the Bologna Process (1999). In particularly, administrative functions in education were transferred to a territorial level (Great Britain, Italy); decentralized institutions received a higher degree of autonomy (Germany); regional areas were involved in the process of national budgetary targeting for the education sector (France). A major intra-university sector was established having joint research centers with scientific institutions, which were separately funded by the government; research clusters with participation of universities were founded.

As a result, universities are involved in interrelated regional, national, and international networks; heterogeneous education management networks are formed, that have an effect on education along with the state. A pluralistic type of education management is complemented by its democratization - university councils include third-party members (Germany, the Netherlands, Norway); they adopt budgets, set priorities and develop strategies. Thus, universities undergo an organizational change of the course that makes them autonomously managed organizations (Paradeise, et al., 2009. p. 235, 229).

Key trends of social evolution-the extension of governmental influence on the public sector management and the distribution of control functions in the heterogeneous field of institutional actors - are analyzed and become theoretically comprehensible in such strategic systems of conceptualizations as "New Public

Management” (NPM) and “Network Governance” (NG) (Ferlie, et al., 2009. p. 13-18).

Conceptualizations in the NPM-model give priorities to market, high efficiency and entrepreneurial management. The state formulates a strategy and creates management tools enabling “steering not rowing.” With the Britain-American origin, the NPM ideas go far beyond the borders of these countries and are widely spread in European countries. As applied to the education sector, they interpret it as an object of market reforms, where education takes over the status of a service and a student - the status of a client. It is assumed that universities have to compete for students, and a student - to “buy” education with a focus on economic benefits: Incomes and positions of graduates, rating of a university as well as with account of prices the student can pay, or considers can pay, for the proposed educational service. The NPM-model looks at research works in universities as a tool of their competitiveness and a component of market relations.

As supporters of the NPM-model believe, competition in these circumstances should stimulate an improvement of education quality, and the government should encourage private higher schools, squeeze out inefficient state universities, and invest heavily in most efficient. The efficiency is determined on the basis of performance indicators, widely used in the industrial sector at the beginning of the last century (this cultural lag is ignored both by theoreticians and practitioners of the NPM-model). As a result, a higher school is conceived as a company headed by appointed, rather than elected, executives; remuneration is dependant on the number of students, and an increase their number is interpreted as an increase in labor efficiency. Thus, the NPM-model ideas turn into the basis for legitimization of commodification processes in education.

The very core of ideas incorporated in the NG-model centers around the fact that coordinated activities of diversified players of public relations provide the society with a higher growth potential in the contemporary cultural situation - the growth which takes into account their wide range of interests and social dynamics, and thereby generating a distributed type of social responsibility and a more comfortable psychosocial environment at different levels of social action. In European countries, a combination of indicators and symptoms of NPM- and NG-models is observed (Paradeise, et al., 2009. p. 245).

The projection of the NG-model on universities is characterized by the development of network partnerships both between educational institutions and between educational clusters and a wide range of social institutions. This network configuration requires distributed management, collective decisions, indirect and constructive participation of State in management, limited differentiation of wages to support team relations in the network (Ferlie, et al., 2009. p. 17).

A confusion of notions used in the NPM- and NG-management models can be found in the Neo-Weberian State (NW) conception introduced into scientific discourse by Pollitt and Bouckaert (2004). Their comparative study of public administration show a

difference between NPM - marketisation processes in two groups of countries: Australia, New Zealand, the Great Britain and, to some extent, in the USA - on the one hand, and in the continental Europe (Belgium, Finland, France, the Netherlands, Italy, Sweden, Germany) - on the other. The second group is distinguished by a more optimistic and constructive attitude towards the role of the state and less enthusiastic attitude to a potential contribution of the private sector to social areas.

The NW - model is characterized by adaptability of government authorities to institutional changes along with a significant role of the state in management and provision of social services, while the NPM- and NG-models tend to deregulation of social areas. Education in the NW-model is considered as a “public” service for citizens but not a market institution, a community supporting horizontal agreements between diversified entities or a result-oriented state agent for third parties concerned (Paradeise, et al., 2009. p. 244-246).

Thus, the strategic systems of social development conceptualizations demonstrate general transformations suffered by a present-day university. The University 3 model takes its origin from these systems and extends its social mission as a corporate entity of knowledge economy and a key driver of economic growth. In this model, the university is conceived primarily as network, creative, innovative and entrepreneurial.

4. DISCUSSION

4.1. Network University

The Network University is a model of cross-institutional interrelations providing a strategic research and education excellence and efficient practices of knowledge production. The subject matter of the “Network University” concept includes research and educational partnerships, interdisciplinary research collaborations, network training programs, virtual learning environments, e-learning practices, academic mobility, matrix management structures, etc.

The formation of the network university model is driven by genetic features of the society directed towards knowledge society development. An emergency of the social network organization was anticipated by the knowledge society concept developed in 1940s-1960s, in particular, in works authored by Drucker. The network approach to construction of society models and its communities was used in 1970s-1990s by Wellman, Braten, van Dijk, Castells.

In 2001, the author of this article developed a network cognitive partnership model referred to as the “integrated research and education system.” It was shown that the integrated educational system was evolving into the basic concept of educational sociomorphism; its systemogenesis and cluster-network types of organization were studied; it was found that the formation of an institutional environmental structure of scientific and educational communities with a university at the heart was governed by the development of an interdependent “environment-method” relational system (Karpov, 2015b. p. 531-538).

Among objectives pursued by university partnerships are the following: Design of efficient communications flowcharts, enlarged access to investigations and developments for companies, intensification of investments in technological research works, engineering developments and knowledge commercialization processes, development of new markets based on engineering achievements, development of new training programs, including corporate programs.

Customized networks of partnerships entrust an educational institution with a specific ecosystem providing cognitive investments in human capital assets. Curley and Formica (2015) define the ecosystem as “a network of interdependent organizations or people in a specific environment with partly shared perspectives, resources, aspirations and directions” (Curley and Formica, 2015. p. 4).

Therefore, a modern university constructing its cognitive space as a network system of scientific and educational partnerships is a global communication link in the knowledge economy. Partnerships with universities can provide not only new ideas, technologies and facilities for industrial companies, but can also give them a promising creative personality together with products developed by this person or future smart products.

4.2. Creative University

The Creative University is a model of an antroposocial system creating a person of the future both in terms of socioeconomics and existentiality. The subject-matter of the “creative university” concept includes the system of creative spaces generating a synergy of cognitive activities as well as the environment for involvement and centralization of talents. Among them are new types of creative education (including research), elaboration of individual educational curriculums for talents upbringing (talents management), training of undergraduate applicants to be motivated to scientific and professional work, psychological and pedagogical methods for generation of scientific and educational creativity, etc.

The report under the “Creativity in Higher Education” project published in 2007 by the European University Association (EUA, 2007) states that creativity, and, above all, the creativity in universities as centers of knowledge creation is a key factor for solution of complicated socio-economic problems and a primary driving force behind the development of a knowledge society. Creativity is becoming a genetic part of university education where research studies are used as training methods (Karpov, 2015a. p. 441-442). The “creative economy” report issued by the UN in 2008 testifies the emergence of a new development paradigm that links the economy and culture by embracing economic, cultural, technological and social aspects of development both at micro- and macro-levels.

The creative function of a university as a social institution transforming the society is provided by its creative structure that can be described as a system of creative spaces. The author of this work underlines three approaches to definition, description and design of creative spaces of a modern university. The creative space in the first approach is presented as a model of environment

surrounding the processes of education and creative activity; the creative space in the second approach is interpreted as a model of cognitive processes; the creative space in the third (complex) approach is considered as a model of cognitive environment in the system of relations connecting the processes of knowledge acquisition and creation to the environment studied in a wide sociocultural context.

The first approach to the “creative space” concept - the model of surrounding environment - is mostly widely used because of its specious utility (usefulness), adaptability to dissimilar tastes, interests and opinions, very often contradictory, as well as because of intellectual accessibility for public discussions not requiring special knowledge. Layouts and decoration of design studios, architect’s offices, research laboratories, rehearsal rooms, Fab-labs, etc. are described in this approach. Of course, it does not mean that this approach gives no chance for deep theoretical studies, e.g., in the field of ergonomics or landscape design. However, empiricism and reliance on public opinion are present in most of implementations.

For example, Witthoft - the co-director of the environments collaborative team at the Stanford University - refers to playing with space as a method for creativity stimulation, bearing in mind such variables as posing, physical things, external view, and accessibility for team members, etc. (Designing Spaces for Creative Collaboration, 2012). Boys (2011) calls this kind of approach to education space design as a “beanbag.”

An example of the second approach to identification and description of a creative space - the cognitive process model - can be a concept proposed by Wierzbicki and Nakamori (2005). The authors believe that “at the end of the 20th century with the advent of the knowledge-based economy, economic requirements led to the need for better understanding of creative processes, micro-theories of knowledge and technology creation.” They use the “creative space” notion to designate a conceptual tool that provides integration of knowledge creation theories: The Shinayakana system approach, the organizational knowledge creation theory and, in particular, the SECI concept - the Nonaka and Takeuchi helix model, as well as the Wierzbicki intuition rational theory (Wierzbicki and Nakamori, 2005. p. 6, viii, ix).

A shift towards the third complex approach to creative spaces is demonstrated by the model proposed by Boys (2011). He wonders: If the idea of a university is formulated as training of students for a knowledge-based economy, what conclusions should be made both in terms of teaching and learning and their related spaces? The Boys standpoint is that the creative space is one of our manners of thinking about the world and its brainchild. Therefore, understanding the relationship between learning and a creative space at different levels demands an analysis of specific sets of social and spatial practices in a relevant context (Boys, 2011. p. 3-7).

Using the complex approach, the author of this work developed a concept and a methodology aiming at studies the cognitive spaces of a contemporary university as a system of creative

spaces. Under the project of the Ministry of Education of Russia (Grant No. 27.1560.2014/K) our research team completed a structural and functional analysis of basic creative spaces of a contemporary university, which were generating its important subsystems: Research and educational, research and entrepreneurial, specialized, cluster-networking, etc. It was shown that definition and quality of the system of creative spaces as ideal types made possible to design a model of scientific and educational ecosystem of a university in its most concentrated and productive version. The comparison of this model with the reality of any university identified opportunities for its modernization. Specific results of the completed study are prepared for publication.

4.3. Innovative and Entrepreneurial University

The innovative and entrepreneurial university is a model of Knowledge Corporation ensuring a rapid technological and economic growth of the society. The most important function of this university is enhancement of competences of students in the socioeconomic sphere and their direct involvement in economic activities.

The subject matter of the “innovative and entrepreneurial university” concept includes an innovative entrepreneurial ecosystem (institutional flexibility), technological clusters (industrial integration), corporate networks of knowledge commercialization (economic integration), formation of advanced technology markets and innovative mechanisms (economic development), training of engineers-businessmen (economic leadership), management of cognitive mobility (distribution of intellectual potential), psycho-pedagogic practices for formation of innovative and entrepreneurial creativity, etc.

Getting motion to a new economic mission of a university was initiated by two important events that took place in the USA in the middle of the last century. June 22, 1944, President Franklin Roosevelt signed the GI Bill of Rights that provided a number of educational benefits for veterans including low-interest loans for business start. Another event was an emergence of venture capital (VC) companies in 1946 in the USA that created a new economic reality for a knowledge person.

In 1999, D. Bell among sources of technological leadership of the USA mentioned high-tech research universities, strong entrepreneurial culture and VC for small-business financing. At the beginning of 2000s, improved quality and productivity of research works at Western universities made them a leading agent in commercial development of scientific knowledge. As a result of collaboration between universities and industry, scientific discoveries were converted into innovative products and commercialized using appropriate business-models. Consequently, a Higher Education 3.0 system was established that integrated education, science and knowledge commercialization.

As suggested by Lane (2013), the multi-campus University model (specially controlled by a heterogeneous institutional structure) bears practical interest from the viewpoint of University 3.0 development. This model teams up different types of institutions and geographically dispersed campuses. This structure enables

them to create multi-disciplinary and cross-institutional collaborations for solution of complicated socioeconomic challenges. Today, the multi-campus higher education system is the basic component of a higher education landscape in the USA. A considerable number of leading state research universities falls into this category (Lane, 2013. p. 3-11).

An expansion of the mission and the institutional base of universities were fixed in conceptions of post-academician science. In 1994, Gibbons et al. (1994) wrote about a transition of knowledge production from Mode 1 to Mode 2, i.e., from monodisciplinary studies, poorly focused on practical usage of their results, to transdisciplinary studies solving socially important problems. The Mode 2 model was characterized by a socially distributed system of knowledge production (Gibbons, et al., 1994. p. 3, 10). In 1995, Etzkowitz and Leydesdorff in their work devoted to the triple helix concept pointed out to a growing interaction between universities, industry and state and interpreted it as a creation of new social and institutional structures for knowledge production, transfer and application for the purpose of knowledge-based economy development (Etzkowitz and Leydesdorff, 1995. p. 15, 16). In 2000, they used the triple helix notion to explain the innovative activities and processes of new technology creation and knowledge transfer by networking (Etzkowitz and Leydesdorff, 2000. p. 111-116). The main idea in the triple helix concept is an entrepreneurial university which plays an important role in socio-economic development as a key agent of knowledge production in combination with traditional missions of teaching and research. The Entrepreneurial University transfers new ideas and skills to students and develops entrepreneurship talents for scientific business.

In 2003, Carayannis introduced the Mode 3 concept of knowledge production, and in 2005, he developed this concept in collaboration with Carayannis and Campbell (2006) in a special work. Mode 3 concept takes its origin in the 21 century and combines a variety of methods of knowledge creation, dissemination and usage. These methods can be inherent in Mode 1 and Mode 2; for example, linear and non-linear models of innovations in Mode 3 can work in parallel. But at the same time they are the result of co-evolution of knowledge, economy, and society, which are based on knowledge and controlled by knowledge. For example, among new methods are knowledge production in multilayer systems of innovative networks and clusters having a fractal form of organization? This heterogeneity generates a hybrid synergy and functional complementarity. The Mode 3 model proposes a polycentric, multi-modal, and multi-level systematic approach to conceptualization, design and management of knowledge funds and flows.

A university related to the Mode 2 model of knowledge production is conceptually close to the entrepreneurial university model, where knowledge is produced in view of application. The University related to the Mode 3 model of knowledge production is operating in co-evolution and combination with Mode 1 and Mode 2 models, i.e., it couples an educational function with fundamental and applied research studies and knowledge commercialization. According to Etzkowitz, this is exactly what an entrepreneurial

university is representing, which performs also functions of a classical research university (Etzkowitz, 2008. p. 32). This hybridization is a result of a progress in subject areas where fundamental knowledge has a high technological and commercial potential; among them are biotechnology, nanotechnology, pharmaceuticals, alternative energy, information systems and technologies. Hence, it is clear that the concept of University of Mode 3 has much in common with the University 3.0 model, taking over the function of fundamental knowledge production.

In 2009, Carayannis and Campbell published a study of the Quadruple Helix model. For creation and promotion of innovations this model integrates a government, academic communities (science and university), industries and civil society (the community governed by principles of openness and knowledge culture, including innovative culture) into interaction structures. This socio-economic configuration, in their opinion, provides Mode 3 model of knowledge creation and distribution (Carayannis and Campbell, 2009. p. 206, 207). It should be noted that earlier, H. Etzkowitz pointed to the civil society as the basis of the triple helix and an essential element in its social structure (Etzkowitz, 2008. p. 74, 11, 16, 62). In another publication these authors wrote about the Quadruple Helix and Quintuple Helix concepts as an extension of the triple helix model. In addition, the Quintuple Helix concept focused on natural environments of the society along with entities of knowledge and innovation production where creative industries were an integral part of economy studied in the Quintuple Helix concept (Carayannis and Campbell, 2010. p. 58-62).

Here are some examples of innovative and entrepreneurial ecosystems.

The Innovation Value Institute (IVI) founded in 2006 by the National University of Ireland in Maynooth in cooperation with Intel corporation supports operations of an international network covering more than 90 organizations, including Boston Consulting Group, British Petroleum, Chevron power corporation, Cisco telecommunications company, Fujitsu electronics and IT corporation and others. In its activities the IVI implements the “triple helix” model by involvement the academic community, government and industry into the innovative process.

The Singularity University founded in 2008 in NASA Research Park in California, provides educational programs, potentials for innovative partnerships and start-up accelerators. Its shareholders and partners are Genentech - the biotechnology company, Autodesk - the largest software provider, Nokia - the transnational telecommunication company, ePlanet Capital venture company, Google corporation, etc.

The author of this article shows that a way to overcome an innovative gap between the university and industry is the establishment of engineering-type consortiums at the university-the contact networking structures integrating the knowledge generation environment into the knowledge technologization environment and providing deep engineering in communications between these environments. The author develops a concept and a business model of a consortium implementing a network

technology transfer in the system of interaction between a university and research institutions, high-tech and venture companies (Karpov, 2012. p. 52-60).

In the strategy of transition from the University 2.0 model (education and science) to the University 3.0 model (education, science, knowledge commercialization), the author selects the following key components: (1) Social and academic - transformation of a university structure; changes in academic community, teaching processes, and pedagogic activities; advanced growth of research and education; (2) research and innovative - establishment of research and technology excellence centers, development the system of open innovations, implementation of the “university at the core of innovative and entrepreneurial ecosystem” conception; (3) economic - flexible responsiveness on labor markets (dialog with the industry), a focus on network economy principles, intellectual property management, economy-promising elements of corporate and multi-campus university models.

5. CONCLUSION

The Higher Education 3.0 sector is a social and economical valuable system of a present-day society. Its institutional basis incorporates research institutions, high-tech companies, innovative companies, industrial consortiums, institutions of innovation-based growth; and its entrepreneurial ecosystems generate and develop efficient tools for transfer of technologies, scientific and engineering innovations.

Universities forming this sector, have three main social missions--education, research, and knowledge commercialization. They are based on models of a network, creative, innovative, and entrepreneurial university. All models are interrelated. The network model generates cross-institutional environment for creative learning and creates cost-efficient structures of scientific and educational cooperation. The creative model provides cognitively efficient training for a scientifically and economically efficient knowledge worker, filling the entrepreneurial ecosystem of the University. The innovative and entrepreneurial model creates structures and processes ensuring competitiveness between network innovative partnerships and providing socioeconomic output of individual creativity.

The socioeconomic role of the University 3.0 entails the creation of basic knowledge society structures. The University 3.0 is evolving into the basis of global competitiveness of national economies and geopolitical alliances, and its entrepreneurial ecosystem generates new, fast-growing industries, promising technology markets, and administrative-territorial spaces of economic leaders.

REFERENCES

- Boys, J. (2011), *Towards Creative Learning Spaces: Re-thinking the Architecture of Post-Compulsory Education*. London, NY: Routledge. p194.
- Carayannis, E.G., Campbell, D.F.J. (2006), *Mode 3: Meaning and Implications from a Knowledge Systems Perspective // Knowledge Creation, Diffusion, and Use in Innovation Networks and Knowledge*

- Clusters. A Comparative Systems Approach Across the United States, Europe and Asia. Westport: Praeger. p1-25.
- Carayannis, E.G., Campbell, D.F.J. (2009), Mode 3 and quadruple helix: Toward a 21st century fractal innovation ecosystem. *IJTM (International Journal of Technology Management)*, 46(3/4), 201-234.
- Carayannis, E.G., Campbell, D.F.J. (2010), Triple helix, quadruple helix and quintuple helix and how do knowledge, innovation and the environment relate to each other? A proposed framework for a trans-disciplinary analysis of sustainable development and social ecology. *IJSESD (International Journal of Social Ecology and Sustainable Development)*, 1(1), 41-69.
- Cole, J.R. (2010), *The Great American University: Its Rise to Preeminence, Its Indispensable Nation Role, Why It Must be Protected*. New York: Public Affairs. p616.
- Creativity in Higher Education: Report on the EUA Creativity Project. (2007), Brussels: European University Association. p44.
- Curley, M., Formica, P. (2015), Introduction. *The Experimental Nature of New Venture Creation: Capitalizing on Open Innovation 2.0 (Innovation, Technology and Knowledge Management)*. New York: Springer Science & Business Media. p1-12.
- Designing Spaces for Creative Collaboration. An Interview with Scott Doorley and Scott Witthoft (2012). Boston: Harvard Business Review. Available from: <http://www.hbr.org/2012/01/designing-spaces-for-creative/>.
- Drucker, P.F. (2008), *Concept of the Corporation*. New Brunswick and London: Transaction Publishers, 362 p.
- Etzkowitz, H. (2008), *The Triple Helix: University – Industry – Government. Innovation in Action*. New York and London: Routledge. p164.
- Etzkowitz, H., Leydesdorff, L. (1995), The triple helix: University-industry-government relations: A laboratory for knowledge based economic development. *EASST (European Association for the Study of Science and Technology) Review*, 14(1), 14-19.
- Etzkowitz, H., Leydesdorff, L. (2000), The dynamics of innovation: From National systems and Mode 2 to a triple helix of university–industry–government relations. *Research Policy*, 29(2), 109-123.
- Ferlie, E., Musselin, C., Andresani, G. (2009), *The governance of higher education systems: A public management perspective*. University Governance: Western European Comparative Perspectives. Dordrecht: Springer Science & Business Media. p1-20.
- Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., Trow, M. (1994), *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. London: Sage. p192.
- Greenaway, D., Haynes, M. (2003), Funding higher education in the UK: The role of fees and loans. *Economic Journal*, Royal Economic Society, 113, 150-166.
- Karpov, A.O. (2012), Engineering platform for technology transfer. *Economy Issues*, 7, 47-65.
- Karpov, A.O. (2015a), Formation of the modern concept of research education: From new age to a knowledge society. *Procedia - Social and Behavioral Sciences*, 214, 439-447.
- Karpov, A.O. (2015b), Integrated and network systems of research education in the knowledge society (by example of the Russian educational system). *Mediterranean Journal of Social Sciences*, 6(6), 529-540.
- Lane, J.E. (2013), Higher Education System 3.0: Adding Value to States and Institutions. In: *Higher Education System 3.0: Harnessing Systemness, Delivering Performance*. New York: State University of New York Press. p3-26.
- Machlup, F., Kronwinkler, T. (1975), Workers who produce knowledge: A steady increase, 1900 to 1970. *Review of Works on Economics*, 111(4), 752-759.
- Paradeise, C., Reale, E., Goastellec, G., Bleiklie, I. (2009), Universities steering between stories and history. In: *University Governance: Western European Comparative Perspectives*. Dordrecht: Springer Science & Business Media. p227-290.
- Pollet, C., Bouckaert, G. (2004), *Public Managements Reform: A Comparative Analysis*. Oxford: Oxford University Press. p328.
- Wierzbicki, A.P., Nakamori, Y. (2005), *Creative Space: Models of Creative Processes for the Knowledge Civilization Age*. Rotterdam: Springer Science & Business Media. p289.