Social Technologies for Innovative Development Management of Technical University

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Abstract The innovative resources of the university are formed on the basis of the managerial competencies of individual management structures. The relevance of the study resides in structuring the requirements for strategic development at the university based on an understanding of the labour market demand. Each university has a deferred demand for the training of specialists, and thus satisfaction of demand is possible only if additional education programs are implemented, which negatively affects the employers’ expenses. The novelty of research is determined by the fact that the innovative development management of the university should be carried out not only on the basis of the fulfilment of key indicators. The authors show that when overcoming crisis phenomena, there is a need for the formation of socially responsible educational institutions that not only implement a plan to saturate the market with specialists, but also contribute to maintaining the intellectual potential of society. The paper indicates that the preservation of innovative potential is possible only with the strategic design of the proposed activities. Practical significance is determined by the need to form a potential restoration of disrupted production and scientific ties between countries based on the results of the crisis. The influx of new ideas and specialists generates innovation, which raise the possibility of the regulation of innovative markets and the creation of highly productive jobs.

Keywords Formalization, Innovation, Structure, University, Education

1. Introduction

Globalisation drivers, their impact on general trends in the development of economy, the integration of domestic science and education in the global scientific and educational space, the growth of the intellectual and spiritual potential of society, the preparation of a new generation of people, the use of modern information technologies that require innovative development of education, fundamental changes, aimed at improving its quality and competitiveness [1]. The development of the education system and the labour market today requires new conditions for unification and functioning, the introduction of an innovative culture in the field of education [2]. The quality of modern education depends on a combination of the educational process, modern scientific research, and innovation in higher education [3].

Despite the positive changes in the education development, numerous problems are still present in this area [4]. So, at the present stage of the development of universities, a significant problem is the formation of insufficiently effective mechanisms for interaction between authorities, educational institutions, employers, trade unions, professional associations for the purpose of
training and vocational training, which significantly limits the employment opportunities of graduates of educational institutions, reduces the cost efficiency of training personnel, slows down the innovative development of both higher education institutions and the economy as a whole [5].

The following factors significantly complicate the development of universities: economic and political instability; demographic decline; weak material and technical base of universities; insufficient level of autonomy of universities; inefficiency of the system of economic mechanisms for resource support of educational activities; decline in the quality of education and a drop in the level of knowledge and skills of students [6]. Now there is a real problem of the inconsistency of the modern labour market demand and the needs of the higher education system development. The educational paradigm requires significant modernisation [7, 8]. In addition, significant problems are associated with budget financing of education, the limited volume, inefficient and imperfect use of existing financial resources of universities [9].

The use of non-government sources of funding for universities is quite limited for various reasons. The obstacle to financial assistance to education from enterprises and financial institutions is the lack of transparency in the budget process both at the level of individual educational institutions and at the district or city level [10]. It is difficult for public organisations or charitable foundations to enter into contractual relations with educational institutions, since they cannot hire employees to perform professional tasks [11]. The use of education lending mechanisms is also limited [12]. Also, the need to update the material and technical base of universities causes a significant dependence of educational institutions on funds that come as tuition fees from students [13].

The situation is created when the struggle of higher education institutions for their own viability led to the commercialisation of public educational institutions, which is dangerous for the higher education system [14]. This inevitably led to a decrease in the requirements for applicants, the quality of education, and the loss of the traditionally high level of vocational training of graduates [15]. Admission of contractors, practically without competition and without any restriction, in the absence of methods for working with poorly trained students at the school level, with a functional focus on mass, continuous training of specialists, reduces the quality of qualified specialists graduated from large state educational institutions [16].

2. Materials and Methods

The resolution of existing problems and the formation of strategic tasks facing the national education system in modern economic and sociocultural conditions is impossible without a targeted progressive growth of universities, which will be based on appropriate conceptual foundations [17]. The concept of innovative development of a higher educational institution is a holistic and systematic understanding of the directions of development of a university, the definition of strategic goals and objectives of universities, ways to increase its competitiveness in the market of educational services through the use of modern technologies and best practices from leading universities [18].

The concept of innovation-driven development of a university determines the prerequisites, purpose, principles, tasks, and mechanisms of university development for the long term [19]. The concept of innovative development of a university should be based on the principles of: scientificity, flexibility, efficiency and complexity [20]. The aim of the university’s innovative development management concept is to determine the strategic goals of the university’s activities and ways to increase its competitive ability in the educational services market through the use of modern technologies and best practices of leading universities of individual countries and the world, taking into account the basic principles of the development of domestic higher education, its integration into the global educational space and The Bologna Process. The formation of the tasks of the concept must be carried out according to the components of the innovation-driven development of universities, which will improve the effectiveness of the university for each component and in general (Table 1).
Financial support for the implementation of the concept is carried out at the expense of the state budget, funds of individuals and legal entities, proprietary funds of the university, investments of national and foreign investors, international technical and financial assistance programs, as well as other sources not prohibited by law. In the authors' opinion, the concept of innovative development of a university should contain the following sequence of stages: assessment of the market for educational services; determining the competitive position of the university in the market for educational services; development of methodological tools for assessing the innovative development of a university; formation of a university innovative development strategy; development of a mechanism for managing the innovative development of a university; assessment of the effectiveness of the innovative development of the university; implementation of a model for monitoring the innovative development of a university by its components (Figure 1).

The first stage involves the assessment of the educational services market. At this stage, the analysis of the main indicators and development trends of the higher education system is carried out, in particular, the number of students, institutes and expenses for higher education. At the second stage, the competitive position of the university in the educational services market is determined. Universities can be evaluated at the local, state, regional, continental and global levels. Each rating provides specific goals and has corresponding target user groups. There are different types of ratings used to determine the best universities in the Russian Federation: university ratings from “QR”; university rankings from UNESCO; university rankings from "RAS"; world university rankings from the Times; university ratings in

| Components of the innovative development of the university | The main objectives of the innovative development of the university |
|----------------------------------------------------------|---------------------------------------------------------------|
| Educational process development                          | • ensuring compliance of the university with the provision of educational services with state standards, European requirements for the quality of training of specialists and labor market demand; |
Scopus; university ratings at Webometrics Ranking; TOP 200 universities. To determine the competitive position of the university, it is necessary to analyse the place of the university in the ratings during the period of study.

At the third stage, the development of methodological tools for assessing the innovative development of the university is carried out, including the selection of assessment methods and the creation of a data bank of indicators for calculating the innovative development of the university according to the necessary components. At the fourth stage, the development of a university innovative development strategy is underway. The theory and practice of strategic management has not yet reached proper development due to difficult economic conditions, lack of funds for the implementation of innovative projects and processes, scientific technologies. Only 30% of universities systematically implement strategic management of an educational institution and have a clear unique mission. At this stage, the strategic goals of the university’s activities, the university’s management tasks are determined taking into account problem situations, and objectives are set that contribute to achieving the goal of the university’s innovative development concept and implementing its management strategy. At the fifth stage, a mechanism for managing the innovative development of the university is being developed, including the formation of a set of measures, principles, methods, levers, and tools necessary for the implementation of the main provisions of the concept of innovative development of universities.

The next step is the selection of criteria for evaluating the effectiveness of the implementation of the concept of managing the innovative development of a university, each of which is characterised by a number of indicators. Thus, the functioning of a modern university in a market economy requires constant systematic dynamic transformations, reorganisation of its subsystems within the strategic goals set by the university to ensure sustainable innovative development. Therefore, the vital objective of improving the university’s management system is to create conditions for the implementation of stable innovative development by rationalising and integrating all processes in the management system and developing an effective mechanism for innovative development. This is explained, on the one hand, by the multitude of multilevel goals of objects and control subjects, which should have a high level of consistency, and on the other hand, by the complexity of their harmonisation.

Figure 1. Stages of the formation of the concept of managing innovative development of a university
3. Results and Discussion

Studying the development directions of higher education financing for the countries of northern Europe (Sweden, Finland, Denmark and Norway), their common features are determined. Based on the contractual system of agreements between governments and universities, higher education is financed in Finland within the medium-term budgeting for a three-year period. The proposed system allows setting specific tasks for universities, and then checking their implementation. Funding for higher education depends on the actual number of master's and doctor's degrees awarded by the university (76% of the basic appropriations) and the size of the university (19%). In addition, there are special trust funds for financing priority branches of scientific research, earmarking for leading research (as assessed by the Academy of Finland) and outstanding teaching work (as assessed by FINHEEC, the state body for assessing the quality of teaching and learning). Higher education in Denmark is financed on the basis of “development contracts” between universities and the government (Ministry of Education), which identify priorities for universities in the field of education and research.

In addition, the contracts denote such indicators as: improving the activities of universities, improving working conditions and training, increasing management efficiency, using information technologies, increasing management efficiency, maintaining educational facilities, libraries, and the like. These “development contracts” are concluded for a period of four years, with the possibility of annual revision, the basis of which is the university’s proposals regarding the goals and objectives of its activities.

Financing of higher education from the state budget in Norway is carried out in the form of grants, which are used to finance the ongoing work of universities and capital expenditures. Grants for universities are determined on the basis of the number of students. Financial support for students is provided on the basis of scholarships and educational loans of the State Bank. A characteristic feature of the Northern countries mentioned above was a decrease in state influence and decentralisation of decision-making in higher education. In most industrialised developing countries, funding is allocated based on input from the educational system. Moreover, the methodology used to calculate the cost has an important impact on the incentives of the institution.

The principle of scientific attitude provides for the formation of specific goals, setting goals, content and methods for solving any problem using the scientific research. This principle provides for the use of the latest achievements in pedagogy, psychology, economics, management, and the disclosure of cause and effect relationships of phenomena, processes, events, the inclusion of scientifically verified knowledge in the teaching aids that correspond to the current level of science. A university as a system operates in a dynamic environment, so timely reaction to changes is the basis for ensuring the principle of flexibility of universities. Changes in the external and internal environment require a quick adjustment of the development strategy, which will ensure the effectiveness of the university. A lack of attention to situational planning of competitive behaviour leads to crises, a decrease in the student body, and a decrease in reputation.

The principle of complexity makes it possible to consider complex objects in inextricable unity, interdependence and mutual influence of all structural elements: goals, objectives, principles, methods, forms, organisation, functioning mechanism. This principle makes it possible for objects amenable to managerial influence to determine the degree of correspondence of each other to all components of the system, the effectiveness of the functioning of its various structures. Using the principle of complexity makes it possible to systematically approach the development of all areas of the university.

The principle of effectiveness provides for the complementarity of the results of universities with established goals. It is not only about comparing the results and goals of the university, but also about the efficiency of using budget funds. Consequently, it is advisable to consider the effectiveness of universities in terms of both their social significance for society and the position in market relations, which provides an assessment of their economic and technological effectiveness.

The construction of modern management of the innovative development of the university requires consideration of the existing theoretical, methodological and practical planes on which its formation is based. In this context, it is important to analyse the dominants of the modern paradigm, which reveal the logic of innovative development. A clear understanding and understanding of the category of the mechanism of innovative development, the ratio and role of its individual elements is important to ensure the effective operation of universities.

In modern scientific economic literature, there is no consensus on the essence of the concept of "mechanism of innovative development". In order to determine the content of this category, in the authors’ opinion, it is advisable to first consider the essence of the term “mechanism”. The term “mechanism” comes from the Greek word “mêchane” – a weapon, a machine. This concept today has the following basic meanings: a device for transmitting and transforming movements, which is a system of bodies (links), in which the movement of one or more bodies (leading) causes certain movements of the remaining bodies of the system; mechanisms are different in design and purpose, form the basis of most machines, devices and other technical equipment; an internal device,
The Great Explanatory Dictionary of the modern Russian language defines the “mechanism” as a device transmitting or transforming movement, internal structure, a system of something, as well as a set of states and processes that make up a certain (including economic) phenomenon. In the dictionary of foreign words, “mechanism” is defined as a set of intermediate states or processes of any phenomena. In economics, the concept of “mechanism” came from technology, as it became necessary to describe social and production processes in their interaction. Moreover, in some cases, a mechanism is understood as a set of states of a system, for example, a “financial mechanism” (a set of states of a financial system); “Mechanism of socio-economic development” (a set of socio-economic conditions of the economic system); in others - the main engine of development (the main element of the structure of the system, especially its interaction with other elements, etc.). A brief economic dictionary describes the concept of “mechanism” as a sequence of states of processes that define any actions, phenomena; system, device that determines the order of any type of activity. In the economic encyclopaedia, the term “mechanism” is interpreted as a system or method that determines the order of a certain type of activity, some links and elements that bring them into action.

The latest interpretation of the concept of “mechanism” was proposed by Nobel laureates L. Hurwitz and co-authors. Having developed the most generalised definition of a “mechanism” that can be applied to any interaction of economic entities, they consider this interaction as a strategic game (a game, in this case, a description of how players (economic entities) will behave and what any set of actions will lead to) and define the mechanism as a form of this game. "Mechanism" is defined as a category, as both an organised and organising system of events, phenomena, processes, which obeys the laws, has a goal, a certain structure, with which the goal is achieved.

The mechanism, as an economic category, is a tool that ensures the progressive development of the object, which is subjected to the driving force of environmental factors. Its structure and content change in the process of development of social production. Therefore, the term “mechanism” in most cases is used in a process sense with a specific word, for example, a control mechanism, a counteraction mechanism, a development mechanism. In most cases, scientists, offering their interpretation of the category “mechanism”, focus only on the constituent elements of this complex category. That is, the interpretation of the concept of “mechanism” is carried out with an emphasis on its various aspects, but all researchers are unanimous that the mechanism is a complex, multifaceted system.

Thus, the mechanism for managing the university’s innovative development is a complex system that includes organisational, motivational and financial approaches, methods and principles of forming an innovation policy that ensure the university’s competitive ability, the level of its socio-economic development and the quality of educational services. The mechanism should contain interrelated principles, methods, levers that are aimed at achieving the strategic goals and mission of the university. Based on the theoretical studies, it is possible to identify the main components of the university’s innovative development mechanism (Figure 2).

![Components of the mechanism of innovative development of a university](image)

The effective mechanism for the innovative development of the university begins with effective organisational steps, which are the basis of the organisational component of the mechanism and includes the construction of a system of relationships between the structural elements of the mechanism and the establishment of relationships between all departments of the enterprise.

The economic component of the university’s innovative development management mechanism is responsible for the strategic management of the university’s innovative development and is associated with the formation of goals, programs, projects taking into account the economic condition of the university, the study of the educational services market, the use of modern marketing tools and ensuring the effective implementation of the university’s budget activities. The list of paid services that can be provided by higher education institutions that belong to public and municipal ownership makes it possible to qualify these services in such main areas:

- the field of educational activity (preparation in excess of the state order within the licensed volume in accordance with agreements concluded with individuals and legal entities, students and cadets of non-military higher educational institutions of civil
aviation, sea and river fleet (hereinafter - students, cadets), graduate students and doctoral students; training, re-training, advanced training of personnel, training for citizens to receive postgraduate education in excess of the state order within the licensed volume; preparation for admission to higher educational institutions and other educational institutions;

- the field of scientific and scientific-technical activity (carrying out scientific-research, design and experimental, design-and-engineering, technologic, search and design-search work; carrying out diagnostics, standardisation and certification of technological processes, equipment and materials, metrological support, technical protection of information; implementation, production and sale of research, industrial, scientific, scientific-technical, innovative products, machinery, equipment, instruments and equipment manufactured using proprietary technologies, etc.);

- the field of international cooperation (provision of organisational, protocol-informational, consulting services, translation services, except for cases when such services are provided to a person who works or studies at an educational institution and is sent by such educational institution for training, internship or work abroad for budgetary funds and the like);

- healthcare and recreation, leisure, tourism, physical education and sports (providing accommodation, recreation and rehabilitation in youth and youth camps, sports camps, tourist camps, sanatoriums, dispensaries, boarding houses, tourism and recreation, including transportation; provision for temporary use of sports equipment and accessories, personal items, leisure items, if this is not provided for in the curriculum and does not apply to activities financed from the general fund of state and local budgets and the like);

- household services (construction, repair and arrangement of housing, household facilities and premises; remodelling, maintenance, diagnostics, commissioning, re-equipment of household, computer, telecommunications, peripheral, copying, office equipment, teaching aids, instruments, equipment and multifunctional equipment, photo, television, video, audio equipment; production, sale and repair of metal products and the like);

- housing and communal services (the provision of specially equipped houses and premises on the balance of educational institutions for temporary residence; the provision of vacant specially equipped dormitory rooms for temporary residence during the holidays, etc.);

The formation of the economic component of the university’s innovative development management mechanism will enable it to successfully commercialise the results of its Research and Advanced Development (and effectively use its main and auxiliary resources for commercial purposes; successfully develop and implement innovative technologies, spin-offs (spin-out) enterprises and launch start-ups companies (getting economic benefits from it); to form an entrepreneurial vision and entrepreneurial skills (character traits), to find and effectively use entrepreneurial opportunities in their educational and scientific activities.

The financial support of the higher education system is associated with the formation and use of financial resources of higher education institutions of various forms of ownership and includes: self-financing, budget financing, and lending. Financial regulation of the higher education system is carried out through financial instruments and methods of distribution of financial resources, on the basis of which the economic interests of subjects of the educational services market are implemented. Commercialisation of educational services necessitates a systematic accounting of direct, indirect, associated and total costs of all types of services. Planning and calculation of total costs per unit of services can be carried out using matrix models that allows controlling the structure of all types of costs at any stage of the process. The use of the motivational component of the university’s innovative development mechanism will make it possible to create an innovative culture and motivation for the innovation activity of each particular person at a strategic level, to choose rational solutions to problems, on a tactical level to form motives for innovative activities in the most effective areas, and at the operational level to control the formation of the system motives and incentives, adjust the direction of motivation. The functional component of the mechanism is to determine the totality of steps and managerial decisions aimed at achieving certain goals of the university's innovative development. Based on the study, the authors believe that the university’s innovative development mechanism should contain the following elements: subject, object, methods, instruments, tools, principles, functions, purpose, tasks, influence factors, and the mechanism support system (Figure 3).
Thus, the increasing pace of scientific and technological progress, the intensification of innovative processes in the global economic system encourage business entities, including higher education institutions, to constantly introduce the achievements of science and technology into their own activities, to accelerate processes, to use new technologies and innovative methods management. Despite the difficult economic conditions, universities in the Russian Federation also face the strategic task of familiarising themselves with innovative processes with the goal of successfully integrating into the global environment and enhancing their own competitive ability. The effectiveness of the university’s innovative development processes depends on a streamlined mechanism for managing these processes and the coordinated interaction of the individual components of the mechanism.

4. Conclusions

The investigated components of the innovative development of a higher educational institution make it possible to establish that the innovation-driven development of a university should be aimed at: developing and improving national and regional innovation system; effective and rational use of the university’s intellectual resources, the formation of a sustainable intellectual potential that can initiate and implement innovative projects of various complexity and focus; commercialisation of scientific ideas, original innovative projects; expanding the range of jobs and practice bases for students, employing students through the creation of firms and joint ventures, including with universities in other countries; raising the level of entrepreneurial culture and training qualified personnel in the field of small and medium-sized businesses.

Based on the analysis of special economic literature and existing approaches to the definition of “management”, it was established that the effective management of the educational process and the introduction of innovations depend on the existing management system in a higher educational institution, and the management system of higher educational institutions is a form of embodiment of managerial relationships in the educational sphere. Innovative development depends on many factors, in particular on the construction of effective economic mechanisms that provide comprehensive support and interest in the effective use of existing financial resources and attract new ones through the creation of favourable conditions. The innovative development of a higher educational institution should be built systematically, taking into account state conditions and the institution's own capabilities, to regulate innovative processes.

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