

Digital Transformation of Tech Universities: Understanding the Evolution with the Entrepreneurial University 3.0 Model

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Introduction

Universities, especially technical ones that develop according to the entrepreneurial type (University 3.0 models) become the core of the knowledge development system. It is necessary to create a favorable innovation environment in universities that will ensure effective interaction between participants in the innovation process at all stages of creating, developing, and implementing knowledge in order to commercialize it most effectively in the context of digital transformation.

To complete the project tasks, we conducted step-by-step analysis and research of the “University 1.0”, “University 2.0” and “University 3.0” models in the conditions of technical universities.



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As part of the work, the authors analyzed the state of the scientific and innovative infrastructure of the technical university in the conditions of the “University 3.0” model.

Digital transformation is changing institutions and businesses around the world, but nowhere is digital transformation more evident than in universities. The drive for digital transformation in universities has been an important factor in enabling higher education institutions to thrive during the COVID-19 pandemic. But digital transformation is not just a response to the crisis. On the contrary, digital technologies will continue to transform teaching and learning, as interdisciplinary competencies become increasingly important, requiring specialists to adapt the skills and abilities acquired in various professions. The boundaries between functional levels are blurring, and improvement will be required for all technical professions.

As the world moves into the digital age, several terms have emerged. In most cases, these terms are used interchangeably. An example would be digitalization versus digitization and even digital transformation, which, although used interchangeably, are still completely different in nature. Primarily, these terms refer to different ways of responding to and absorbing new technologies. Therefore, it is crucial to understand the difference between digitalization and digitization.

While digitalization is about applying technology to existing business processes and workflows, digital transformation means reorienting these processes to a new, digital approach. Consequently, digital transformation is much broader, and digitalization and digitization are key components of any digital transformation initiative.

Universities, especially technical ones, that develop according to the entrepreneurial type (*University 3.0 models*) become the core of the system of knowledge development and its practical use. They accumulate highly qualified personnel who are able to perform complex interdisciplinary research and project work for enterprises and organizations and are also able to create a theoretical and scientific-applied base for the scientific and technological progress of the economy and society.

The globalization of the world economy and society leads to the fact that the creation or improvement of technologies and methods cannot be a source of competitive advantages for technical universities, enterprises or countries for a long time, but their constant development is necessary. The benefits of technological progress will be much broader and longer lasting if we ensure the formation of an innovative environment that ensures their constant involvement in innovation activities.

This paper is devoted to the development of ways to change the scientific and innovative infrastructure of a technical university in the digital economy. The paper considers problematic issues of the evolution of the institutional organization of modern higher education institutions in Uzbekistan in the context of digitalization of society. The main factors determining the process of qualitative change «of the “University 3.0” model» in changing educational spaces are considered. The problems of the issues studied in this paper reveal the peculiarity of qualitative changes in the development of the institutional organization of higher education institutions and represent an important direction of modern scientific reflection, which allows using the author’s analytical conclusions in promising research on this topic.

Analysis of Scientific and Innovative Activities of the Technical University

The reason for different interpretations of the category “innovation” is the versatility of innovative phenomena. In a broad sense, the concept of “Innovation” reflects the result of a radical modernization of the technological foundations of production, and due to the fact that it is an innovation, it is characterized, first, by a high level of uncertainty of a certain economic entity, and secondly, by its long-term efficiency during its life cycle, that is, by the continuity of the innovation process. It follows that innovation combines originality and consistency.

The economic categories “innovation” and “innovation process” are close to each other, but do not coincide. The innovation process is a set of successive stages, such

as the creation, adoption and dissemination of innovations, that is, a necessary component of a reproducible innovation system.

An analysis of global development trends shows that innovation, innovation activities and a knowledge-based or innovative economy play a key role in solving the full range of strategically important problems of various countries in the 21st century. The level of technological development is one of the most important factors determining the degree of socio-economic development of the state, its economic and political independence. The transition to the path of sustainable development of such countries as the United States, the European Union, Japan, and a number of Southeast Asian countries was achieved by expanding innovation processes in the real sector of the economy. Over the past 25-30 years, the number of people working in the innovation sector in the United States and Western Europe has increased by more than 2 times, and in Southeast Asia-by 4 times. In the European Union, the share of innovatively active industrial enterprises was more than 50%, although within the EU this indicator varies significantly for different countries. In the developed world, more than 75% of GDP growth is achieved through innovation. The effectiveness of innovations in these countries is based on the existence of a system-forming mechanism, named by K. Freeman “National Innovation System” (NIS), in his work on modeling technology policy in Japan. Noteworthy is the result of a survey conducted by the American Academy of Sciences, in which American economists recognized that the most outstanding event of the 20 century was the formation of a national innovation system. Although the last century was rich in various discoveries: jet aviation, television, nuclear power, space, the Internet...Why?

Because it is the national innovation system that is the mechanism that creates a process that allows you to meet any need of society.

Currently, Uzbekistan is undergoing an intensive process of forming a national innovation system. This is evidenced by the Decree of the President of the Republic of Uzbekistan “On approval of the strategy of innovative development of the Republic of Uzbekistan for 2022-2026” dated July 6, 2022 No. UP-165, aimed at

accelerating innovative development in the republic, widespread introduction of innovations and technologies in all sectors of the economy, development of human capital, scientific and innovative spheres.

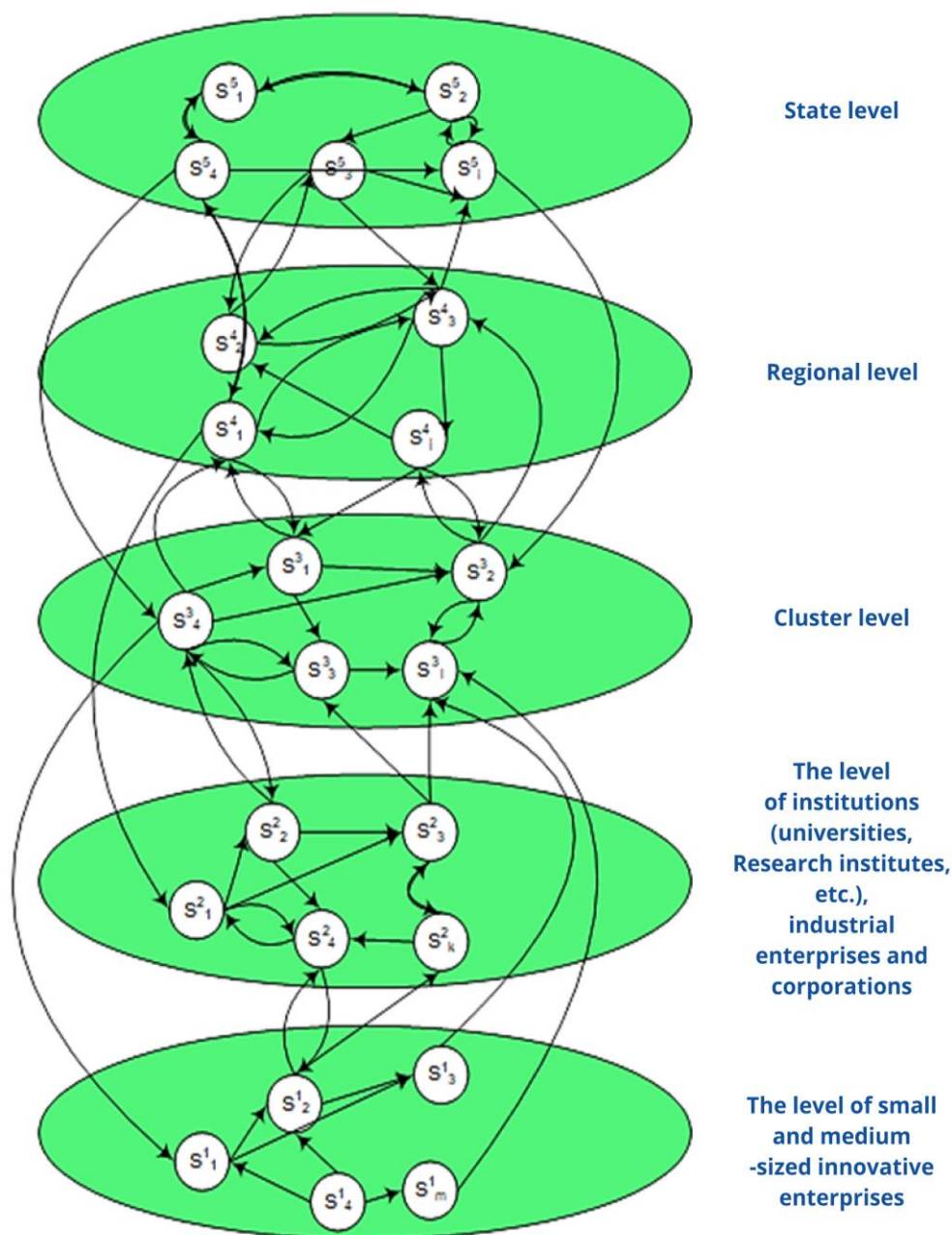


Figure-1 Fragment of the structure of the national innovation system

The Decree pays special attention to the need to increase the degree of commercialization of scientific and innovative developments, the level of cooperation between science, education and industry in the real sector of the economy.

Innovation centers and small and medium-sized innovative enterprises can and should play an important role in solving these complex tasks (Figure 1).

There are great opportunities for small innovation centers, which, unfortunately, are extremely insufficient today. What mechanisms should be used to fill this niche of the innovation infrastructure formed by the National Innovation System is a separate issue that requires in-depth analysis. Let us note only one aspect of the problem related to the central role of enterprises in the innovation process: multi-faceted innovation centers with a developed scientific component can produce knowledge and even stimulate demand for it, offering new, previously unknown technologies, the mastery of which ensures the strengthening of specific positions of enterprises, but it is the latter that carry out the practical implementation of innovations, their promotion to consumers and the formation of feedback.

Sharing the practice of developing technical universities in the post-Soviet space and in foreign countries, as already noted, allows us to draw a conclusion about the practical implementation of various institutional models of a modern technical university: “University 1.0, 2.0, 3.0, 4.0”, including the theoretical development of the “University 5.0” model.

At the same time, the model of a modern technical university is understood as an ideal and generally presented multicomponent and multi-level structure of a higher education institution that performs its historically determined role and normatively defined functions in the education system and in society.

In the provisions of analytical reports and government documents on the implementation of the strategy for sustainable socio-economic development of the Republic of Uzbekistan for the period up to 2030, the recommendation part notes the expediency of improving the activities of universities based on the “University 3.0”

development model and the transition to a network system of higher education institutions through clustering (formation of educational complexes – clusters that unite institutions of various levels of education).

World experience shows that the “University 1.0” model existing in the traditional education system is limited to teaching, including teaching and research.

Since the introduction of the new public administration system in higher education at the end of the twentieth century, the management approach, which includes quality assurance systems used in industry and enterprises, has been increasingly applied in the non-profit and public sectors. National governments and universities have followed this path. In addition to the large institutional and financial autonomy of a number of States, they have developed public accountability and quality assurance systems to ensure that technical higher education and research institutions meet national and international standards. Technical universities began to take part in open international and national competitions in order to receive additional funding (mainly models “University 2.0, University 3.0”).

Because of this ambiguity, an independent culture of pedagogy - innovative pedagogy-is rapidly developing today.

A special feature of innovative education is to increase the student’s sense of responsibility and self-confidence in the future (Figure 2).

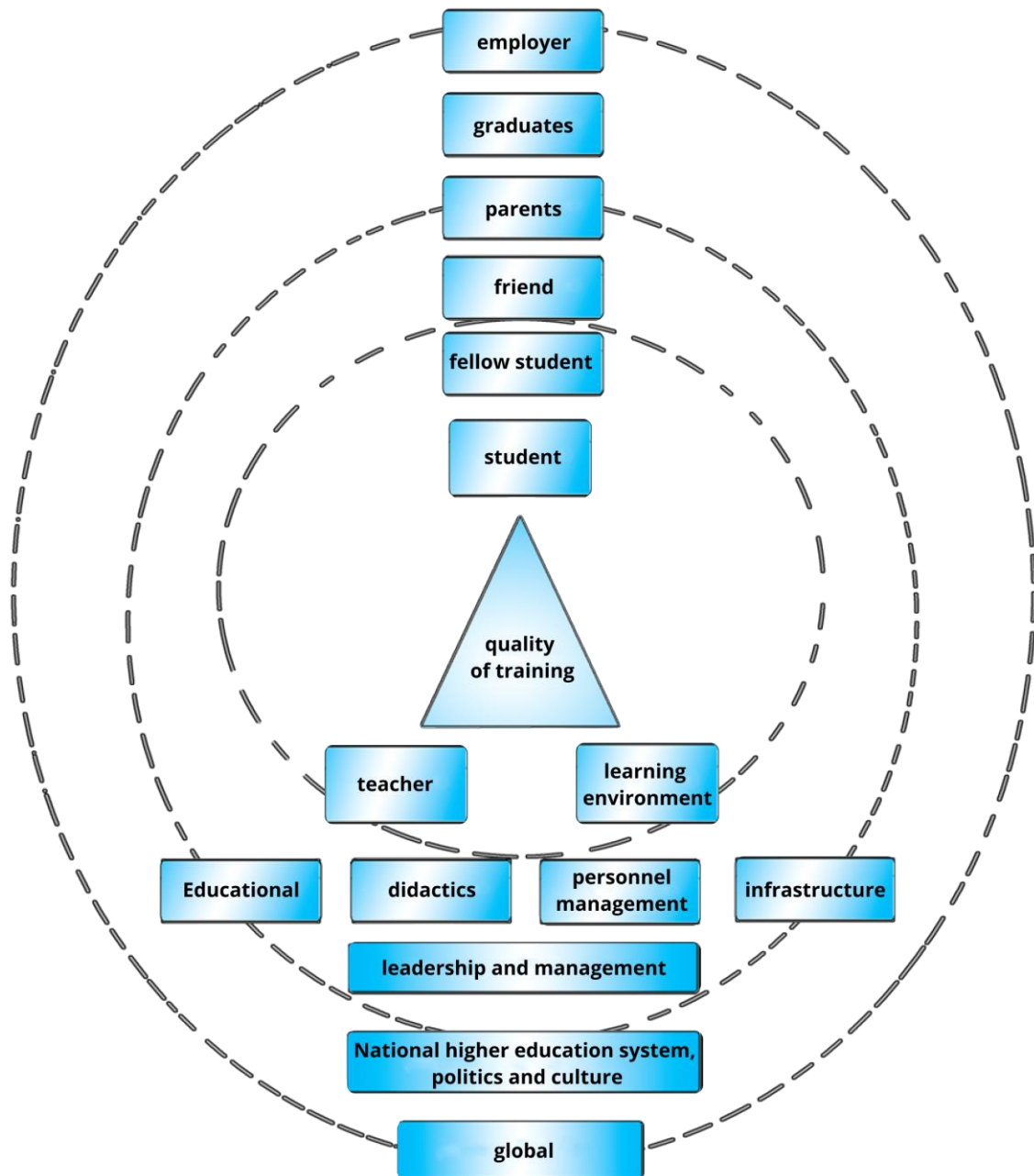


Figure UNOC-2 Participants and factors influencing the quality of education in technical universities

The University 3.0 model meets the needs of the post-industrial stage of social development, focused on innovations and the needs of the knowledge industry, the development and application of innovative technologies and technical solutions in a

new high-tech production (transition to the digital industry, miniaturization in electronics, production automation, creation of high-performance computers, microchips and automated systems, production of materials with specified properties, etc.). etc.), as well as the growth of the service sector and consumption. The processes of social development actualize the increasing role of universities in the development of human capital, in the formation and development of specialists with such universal competencies that allow them to effectively carry out professional activities in various fields.

Within the framework of the described model, the university is an institution of higher education of an entrepreneurial type – entrepreneurial based on the results of the creation of innovative companies and entrepreneurial by the nature of the interactions of the management team - managers – university management and business representatives. At this stage of the development of its institutional evolution, the university strives to attract additional investment, intensively uses innovative technologies in the pedagogical process and closely interacts with businesses interested in the practice-oriented developments of university scientists. In the implemented institutional model “University 3.0” creates favorable conditions for the formation of high-tech start-ups and spin-off companies with the participation of students and teachers. Along with the cultural, educational and research functions already traditional for its activities, the institution of higher education performs the function of transferring advanced technologies that it commercializes. The University is becoming a powerful research center that, in the conditions of clustering, produces for the needs of the market those innovative technologies and products that are demanded by the consumer. In terms of material equipment, the University 3.0 includes in its structure, along with classrooms, laboratories and libraries, business incubators and technology parks, design bureaus, project offices and exhibition centers.

By attracting investment, the university is increasingly striving to be financially independent of the state. At the same time, the integrating function of the university institutional organization model 3.0 is not only to play an active role in the processes

related to the commercialization of technologies and technical solutions, but also in the development of business structures through their integration and consolidation, as well as the formation of new markets. A classic example of the implementation of the model of such a university is Stanford University and the “silicon valley” formed with its participation.

Within the framework of the “University 3.0” model in the history of education, a transition to a new educational paradigm “Education through life” is being carried out, which naturally cannot but strengthen the position of universities as system-forming centers of continuing education that promptly respond to requests for training or retraining of specialists necessary for the labor market.

Modernization of the higher education system (visual modern – updated, modern, fast-growing) requires a relatively innovative approach to education:

- the need to develop professional and innovative competence of the teacher in relation to the development and implementation of pedagogical innovations;
- commercialization of research activities and innovative approach to education.

These innovations and transformations require constant study, analysis and generalization of the best pedagogical experience in implementing commercialization and innovation in higher education in countries such as China, Japan, Korea, the United Kingdom, etc.

The future society is a society of knowledge and innovation. The main function of a modern technical university is to train innovators. An important form of entrepreneurship is knowledge-based entrepreneurship based on the integration of science, education and culture. For this reason, the concept of intellectual entrepreneurship is being developed today.

The essence of project-based learning: the student must be able to perform useful, thoughtful work, perform real tasks in the field of their future career, and communicate their solutions to real consumers. This requires that the learning process be carried out in the same way as designing a situation of uncertainty. The

teacher should create the conditions for this, and the student should be the builder of their knowledge, not the recipient of information. The student must move from “mastering” knowledge to “creating”, that is, to the standards of “think-design – implement-manage”.

Analysis of Socio-Economic Conditions of Digital Change in Scientific and Innovative Activity

The social impact of an entrepreneurial innovative approach to education in the context of globalization, as well as the socio-pedagogical impact of an innovative approach to education in the context of globalization, is changing dramatically (and in the era of the destruction of the unipolar world in which we now find ourselves, it is likely to undergo huge structural and politicized changes):

1. Scientific and technological progress and socio-economic renewal of the continuing education system, studying the best practices of higher education, applying innovative approaches to education and using information technologies;
2. Introduction to the practice of a comprehensive organizational form of technical-oriented training, which serves to develop the level of knowledge, intellectual abilities, social activity, and creativity of students;
3. The need to develop professional and innovative competence of the teacher in relation to the development and implementation of pedagogical innovations;
4. Commercialization of research activities, innovative approach to education is based on the fact that the content and result of education are personality-oriented, the content, form, method and vocabulary of education are based on the latest achievements of science and technology (Figure - 3).



Figure 3. Functions of a classical University

These innovations and transformations require constant study, analysis and generalization of advanced pedagogical experience in implementing commercialization and innovation in higher education in countries such as China, Japan, Korea, Great Britain, etc., as well as using the achievements of pedagogical and psychological science in practice, using modern pedagogical and information and communication technologies.

Teaching methodology – is a system of teacher-student relationships that ensures the assimilation of the content of education.

The teaching methodology is considered the main part of the learning process and characterizes the interdependence of students in the educational process, so without

the appropriate methodology, it is impossible to carry out purposeful educational activities.

How to use interactive learning methods in a group.

As a practical direction of modern pedagogical and psychological research today, several teaching methods in pedagogy are distinguished:

1. Passive – the learner acts as an” object “ of learning (listening and playing).
2. Active – the student shows himself as a primitive learner (independent work, creative tasks);
3. Interactive - mutual cooperation between teachers and students. Such a group of students can be divided into “student-teacher” and “student-student”. In interactive learning, the teacher is an active organizer of learning activities, and the student manifests himself as the elbow of this activity.

Interactive learning is the most effective organizational form of developing cognitive activity, characterized by the transformation of the student from an object of learning in interactive learning to a subject of self-integration.

Interactive learning not only develops students activity, creativity and independence in obtaining information, but also provides comprehensive support in the implementation of educational goals.

Closing the modern system of higher education in our country, of course, requires the full use of advanced technologies from all over the world.

Today, advanced educational technologies are divided into 4 groups:

1. Problematic technology.
2. Didactic game technology.
3. Technology Collaboration.
4. Modular technology.

A modern university is an active, multi-faceted and effective institution of society, which must simultaneously solve the following three main tasks:

1. the task of education;
2. the task of scientific research;
3. the task of innovative entrepreneurship.

The main aspects of the University of Entrepreneurship:

First, entrepreneurial universities are engaged in social entrepreneurship. The essence of the University of Entrepreneurship can even be classified according to the following 4 aspects, highlighted by Yu. Schumpeter (1883-1950):

1. commitment to innovation;
2. ability to take risks.
3. self-confidence.
4. feel independent.

The entrepreneur engages in “creative destruction” and implements new combinations of resources.

Secondly, it has a multi-channel system of financing its activities. Its main sources are:

1. Implementation of educational services,
2. Publication and sale of educational and methodical literature,
3. Raising funds from businesses through participation in joint commercial projects,
4. Revenue from the implementation of regional orders,
5. Government orders,
6. Graduates,
7. International charitable (sponsorship, charitable) organizations,
8. Fundraising (fundraising for various purposes),
9. Endowment (charitable investment fund, very important support of the university community).

Third, it constantly promotes initiatives to participate in new activities, such as strengthening competitiveness and diversification of activities, and improving marketing services.

Fourth, he performs a profound transformation in accordance with his inner strength (constant). Entrepreneurship University -is an ambitious goal+effective organizational change. An entrepreneurial organization will need a new balance between science, education, and innovation.

Fifth, it takes interaction with the external environment to a new level, adding international relations.

The University of Business consists of:

- First, the university is an entrepreneur within the framework of its mission.
- Secondly, the university is an innovator. Its subjects are innovative, its activities are innovative, and its products are innovative.
- Third, the university is an integrator. The activities of all its subjects are focused on the final result and are carried out synchronously with the regional community. It is a member of “strategic associations” in cooperation with leading domestic and foreign universities.

Key features of University 3.0:

- extensive cooperation with industrial companies, investors, venture funds, large corporations, scientific organizations and other universities,
- the main task of a new generation university is the formation and commercialization of knowledge,
- a adaptive selection (competition) for the best specialists, students and research contracts,
- in high international ratings,
- the policy of globalization - teaching is conducted in English,
- reducing the burden of public administration and intervention.

The state University continues to fund 3.0, but funding will be provided through third-party tools to reduce the impact of research and policy development. The University also receives funding from alumni and charitable sponsors. Table 1 provides a comparative description of university concepts.

Table 1. Anequal odescription of university concepts

	University 1.0	University 2.0	University 3.0
	Medieval Europe gumboldt	research	Entrepreneurship
purpose	Education	Education, research	Education, research, commercialization
Research methods	Educational to *	content * Aimed at monophanes	Multi-discipline, Interdisciplinary
Language of Instruction	Latin (NY)	National Languages	English
Graduates	Professionals Specialists	Researchers	Professionals, Researchers, Technology Entrepreneurs
Non-structural units	Schools, Faculties, Colleges	Faculties, Departments	Institutes, HEIs, Universities, Academies
Supervisor, requirement	Rector	Professor	Professional Managers
Degree of Influence	Local	National	International
Tidying	up Autonomous	State	Autonomous
Level of Educational Opportunities	Massa	Elita	Popular and elite

The University of Entrepreneurship includes two organizational areas: scientific and educational and entrepreneurial and solves two tasks: the first is training future entrepreneurs, and the second is an entrepreneur-innovator (Figure 4)

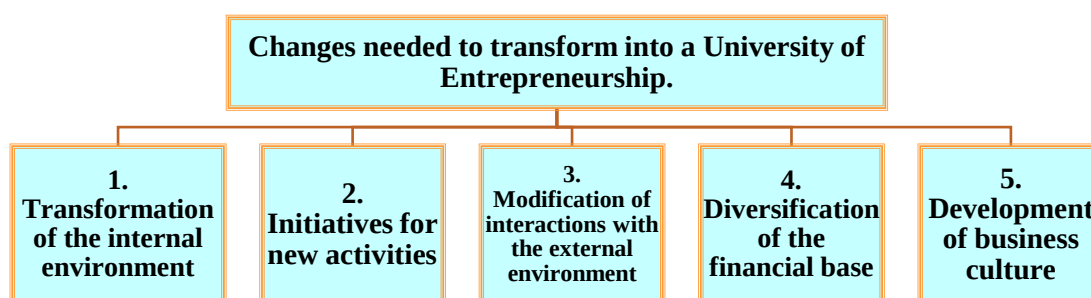


Figure 4. Stages of change for transition to University-Entrepreneurship (3.0)

The future society is a society of knowledge and innovation. The main function of a modern technical university is to train innovators. An important form of entrepreneurship is knowledge-based entrepreneurship based on the integration of science, education and culture. For this reason, the concept of intellectual entrepreneurship is being developed today.

High-quality educational services in modern conditions are achieved only through the active participation of teachers not only in the educational process, but also in scientific, advisory and innovative activities.

“Commercialization of technologies” is a process in which research results are transformed into goods and services on the market. The results of commercialization will bring not only financial benefits in the form of investment in research, but also in the form of expanding production, improving its quality and reducing the cost of production.

“Technology commercialization” is a form of technology transfer in which the consumer (buyer) obtains the right to use knowledge and pays it to the owner (developer of the technology) in one form or another in the amount established by the terms of the license (or other) agreement.

The goal of commercializing the results of intellectual activity is to better meet the needs of:

Educational institution-in the conditions of life and development of its teaching staff, in the training of highly qualified specialists.

in society - in the expanded reproduction of personal and intellectual potential.

In order to become a business university, first of all, the basic conditions that are closely related to the university charter are included - creating goals, there must be concepts, including: transition from a vertical university to a police university; promote the model of knowledge dissemination throughout the community, cultural change through an innovative program.

Since the University of Entrepreneurship focuses primarily on applied research and innovation, teachers are required to go beyond theoretical questions and study the real-world strategies and practices of successful corporations and countries. The innovative potential of scientific activity is a priority in the development of a market economy.

Research results are reflected in products and services. The research areas of the University of Entrepreneurship, in turn, can be divided into two, namely engineering and social and humanitarian.

The main thing is to create a creative, innovative and entrepreneurial atmosphere for teachers and students in such universities. There is evidence that science is turning into money. Innovation means turning knowledge into big money. The problem we face in this regard is that knowledge does not translate into money. That is why the issue of developing a new type of innovative thinking, where managers at all levels can use innovative and project support, is on the agenda today. The solution is to create a new institute-the club of “ professors-entrepreneurs “(founders). It will also be necessary to solve such issues as organizing free consultations, business modules and seminars, training programs, and forming an interdisciplinary accelerator class.

In the context of a globalized market, it is important to learn how to commercialize your ideas and developments.

In the United States, for example, the ability to expand new knowledge and projects is secondary. On the contrary, knowing how to negotiate, collaborate, and find partners to commercialize your business is a key link in the innovation chain. It is a rare case when one person has both entrepreneurial and research abilities-the basis for creating a high-tech business.

In a classical university, relations with the environment are episodic and have a predominantly vertical form. One of the most important aspects of the University of Entrepreneurship is its desire to constantly accelerate and diversify its interaction with the external environment, including international relations. Today, innovation in education also means integration.

The University of Entrepreneurship interacts with 2 organizations: research and education and solves 2 tasks: 1) prepares future entrepreneurs and 2) shows himself as an innovative entrepreneur.

The University of Entrepreneurship affects the environment through two factors: innovative and intellectual potential and entrepreneurial initiative (creative software and students). Henry Itzkowitz “Triple Helix”: - “In the model, government, business and education are closely intertwined, with the university playing a key role.” In other words, a three – pronged approach is being launched: market dynamics – dynamics of knowledge creation-dynamics of political and legislative acts in the field of innovation, the “fourth spiral”, i.e. cooperation of the university with the state, business and technology parks (as representing the interests of consumers). The only way to develop an Entrepreneurship University is through training and mutually beneficial cooperation with strategic partners-universities, technology platforms, innovation zones, clusters, the state, and state corporations.

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