The concept of a university’s scientific and educational mechanism with elements of Industry 5.0

Abstract.

In the modern world, the sustainable development of the state and society largely depends on the ability of its economic and economic mechanism to successfully evolve in a strategic historical perspective, taking into account and adequately responding to global challenges and threats. The most important condition and organic component of effective socio-economic development of the country is the timely transition of its university system to the model of "smart university" - University 4.0 with elements of Industry 5.0 and ESG principles. This approach will allow: to attract a significant proportion of creatively minded teachers and scientists of the university sphere to research and development, as well as to rally creatively minded specialists around them; to base educational processes on advanced achievements of science and technology, including the processes of digitalization and digital transformation, the introduction of the principles of Industry 5.0 and ESG development of cybersocial digital ecosystems; to form and use advanced forms of organization of science, scientific and innovative collaborations reflecting a single science-education-industry complex.

The article presents and substantiates the conceptual provisions on the transition of the university from an earlier model to a 4.0 model with elements of Industry 5.0 and ESG for the development of cybersocial digital ecosystems. The article presents the results: a provision has been developed on the objective contradiction of the development of scientific and technological knowledge of society, which determines the need for universities to switch to the 4.0 model based on Industry 5.0 and the principles of ESG development; the principles of scientific and self-growing scientific and educational value of the 4.0 model university have been substantiated; the creation of a chain of scientific and educational value is justified.
1 Introduction

1.1 Relevance and assessment of the current state of the scientific problem being solved

The sovereign, progressive evolution of any state and society is based on their ability: 1) effectively use the achievements of scientific and technological progress for the purpose of permanent modernization of the economic and economic mechanism; 2) adequately respond to existential challenges and threats of strategic development; 3) identify and resolve situational risks in a timely manner [1], [2]. An important scientific and practical problem for the modern state, in the context of the three above-mentioned abilities and related tasks, is the insufficient effectiveness of the model of the university scientific and educational mechanism in general and in particular in the field of training effective managers for the economic and economic sphere. The problem needs to be solved in order to achieve sustainable ESG development of the country in the context of digitalization of the economy [3], [4].

In the current historical period of transition to a post-industrial integrated cyber–information society (hereinafter referred to as the CIF society) [1, 5, 6], the formation of an institutional framework for education and subsequent full-fledged use by society in all spheres of human "transformative intelligence" becomes decisive for the country [7]. Today, transformative intelligence is increasingly being promoted to the position of the primary basis for the formation of human capital and the professional level of the country's human resources potential [8]. The expression "people are the new oil" should be understood in the sense that now it is the value of a human carrier of transformative intelligence that is increasingly becoming the core of human capital and a new key factor of production [9], [10].

The problem of the insufficiency of transformative intelligence in the management corps in modern conditions is becoming particularly acute. Specialist managers in all fields and fields of economic and economic activity are decision–makers. No significant or insignificant, trivial or non-trivial solution can do without them. And accordingly, the cumulative impact of the management corps of this sphere on the evolution of the state and society, in the context of the transition to an information society, is unprecedented. This obliges universities, on a priority basis, to ensure high-quality training of these specialists based on the formation of effective transformative intelligence.

Currently, the task of determining the optimal model for the innovative modernization of higher education, and in particular university education, has moved to the mainstream level. It is widely recognized by the state and society that, in general, this is a requirement of the time, as well as a tool for solving the problem of sovereignizing the mechanisms of development of the state and society. It is also obvious that there are many unresolved problems in this area that we inherited from previous generations. Today, it is proposed to achieve the solution of this task through the transition to a new model of university education – to a "smart university" model 4.0 based on Industry 5.0, ESG principles for the development of digital cyber-social ecosystems [11, 12, 13].

The purpose and objectives of scientific research.
2 Materials and methods

In the course of the analysis and synthesis of factual and analytical material, the approaches of the theory of systems, as well as the tools of the systemic approach, are used.

The concept of system dynamics and organizational system engineering is used for logical modeling.

Logical analysis and synthesis were used to study the essence of the key concepts of the concept of sustainable development, as well as institutions and goals of sustainable ESG development.

To solve research problems, the following tools have been developed: the concept of "transformative intelligence" of a specialist manager - graduate of the university 4.0 has been defined; a conceptual provision has been developed on the objective contradiction of the development of new scientific and technological knowledge (abbreviated as "NSTK"), which reduces the pace and quality of scientific and educational tracks;

To develop tools for the transition to the 4.0 model university based on Industry 5.0, ESG principles for the development of digital cyber-social ecosystems, the authors' long-term experience in teaching management disciplines within the framework of economic and managerial educational specializations was used.

CCSEV is developed on the example of the discipline "Strategic Management", taught within the framework of economic and managerial educational specializations.

3 Results

3.1 The concept of transformative human intelligence.

The transformative intelligence of a specialist manager, a graduate of the 4.0 university, is the organizing basis of his human capital and represents a system complex of skills and abilities (abbreviated as "CSA") the manager, the main of which are as follows: 1) CSA to reasonable to choose a paradigm of complex, multidimensional (with optimal dimensionality) understanding of the problem/task being solved (analysis and evaluation); 2) CSA [in the absence of clear prerequisites for choosing an existing paradigm of understanding] independently or in a working group to form a conceptual basis for a
complex, multidimensional understanding of the problem/task being solved; 3) CSA to develop professional management solutions in a complex, multidimensional coordinate system to solve problems/tasks of the economic and economic mechanism.

3.2 The provision on the objective contradiction of modernity in the field of scientific and technological knowledge development

The need to move to University 4.0 (smart university) based on Industry 5.0, ESG principles for the development of digital cyber-social ecosystems is determined by objective circumstances. They are related to the processes of global digitalization, the formation of intellectual ecosystems, and the unsuitability of the scientific and educational mechanism of earlier university models (models 1.0, 2.0 and 3.0) [4], [16]) in order to cope with one of the most important contradictions of our time. The contradiction lies in the fact that society needs to support an accelerated increase in the volume of generation and the scale of use of scientific and technological knowledge (abbreviated as STK). But at the same time, this cannot be done due to the limited resources for generating and mastering knowledge, which are available to both an individual and the most important institutions of society. Further, we will abbreviate this contradiction briefly – "the contradiction of scientific and technological knowledge" or the contradiction of STK [17], [18].

Obviously, the earlier organizational models of the university cannot cope with this contradiction, since they are not designed for this. The contradiction of STK [as an organizational mechanism, as part of its most important predicates (submechanisms)], in relation to the modern concrete historical stage, is presented in detail in Table 1. Each predicate of contradiction is formed by two mutually exclusive development trends [19].

<table>
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<th>№</th>
<th>Contradiction of STK-1: &quot;The contradiction of the increase in the actual volume of scientific knowledge (STK) and limited psycho-physiological, as well as social opportunities to master and effectively use these volumes of STK&quot;</th>
<th>Contradiction of STK -2: &quot;The contradiction of the accelerated complexity of STK, which must be assimilated and the insufficient readiness of man and society to assimilate it&quot;</th>
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<td>III.</td>
<td>STK-3 contradiction: &quot;The contradiction of the need to increase the investment of personal resources (time and effort) in the development of STK and reduce</td>
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Due to the increasing volume and simultaneous complexity of STK, as well as the increasing drift of scientific knowledge towards interdisciplinarity, it requires more and more personal effort and time from a person to master it. A person no longer has the time and effort to master the increasing volumes of STK, and even on the contrary, the lifestyle requires a person to develop new areas of personal growth that are not directly related to the profession. Thus, an increase in the workload at work determines the need to take an increasingly responsible approach to personal recreation, the complexity of society requires more and more attention to family and children, etc.

* Compiled on the basis of an analysis of the STK of the economic and managerial sphere) [19], [20]

The STK contradiction [as part of STK-1, STK-2 and STK-3, Table 1] forms an existential systemic challenge of our time, the essence of which is the uncontested transition of society to large-scale, effective education of transformative intelligence among its citizens. The unresolved nature of this challenge will become an obstacle to sustainable evolution in the strategic perspective. The challenge must be solved precisely on the basis of overcoming the objective contradiction of STK.

To overcome the objective contradiction of STK, it is proposed to reform the scientific and educational mechanism of the university on the basis of updating the chains of creation of scientific and educational value [21] (hereinafter abbreviated as "(CCSEV)"), as part of the transition to the university 4.0 model.

The transition to the new CCSEV will allow for a radical increase in the scientific character of the entire scientific and educational mechanism of the university 4.0. The expected result is overcoming the problems caused by the STK contradiction. Including such important problems as: a) the natural cognitive limitations of modern man, which do not allow him to keep up with scientific and technological progress; b) insufficient flexibility of society and the state in organizing educational processes; c) resistance of man and institutions of society to advanced achievements of scientific and technological progress, etc.

Regulation 1. On the general basis of sustainable corporate ESG management and radical changes in the university education system in the proposed circumstances

Research ideas on the universal sustainable development of human civilization, proposed in works on system dynamics by such authors as Meadows Dennis L., Meadows Donella H., Randers J., Behrens V. and others (1991, 1992, 1995) in 2015 received their institutional embodiment through the development by the UN General Assembly of a set of 17 interrelated goals for "... achieving a better and more sustainable future for all"¹.

The formation at the international level of a theoretical, methodological, and regulatory institute for sustainable ESG development was associated with the need to create (within the framework of plans to achieve universal sustainable development) an institutional meta-system of inclusive business involvement in solving the problems of ensuring long-term prosperity of society [22, 23].

Therefore, the institutionalization of sustainable business development began to be realized through the formation of a special philosophy of corporate governance - the philosophy of institutional responsibility and business involvement in the development of society (hereinafter abbreviated as the "philosophy of institutional responsibility of business"). The result of the implementation of this philosophy was to create a special mechanism for ESG management of the corporation. Such a mechanism that it ensured the complementary, synchronized development of the corporation and its contribution to the...
development of the most important subsystems of society - the key triad of sustainable development. This outlined the areas of institutional responsibility of corporate ESG management: a) "Environment" (in the direction of its conservation and rational use); c) "Social system of society" (in the direction of its social and institutional development and improvement); b) "Economic system of society" (in the direction of ensuring the contribution of the corporation to achieving economic growth).

The Global Institute for Sustainable ESG Business Development has begun to make efforts to reorient the corporate sector, as a whole, to Messianic principles in interaction with society. The visible result of this work should have been the simultaneous: a) provision of corporations with new factors of economic growth, b) solving the most important problems by society and creating additional conditions for achieving sustainable development.

After the formation of the Institute of sustainable ESG business development at the global level, the theoretical platform of the concept of sustainable development began to transform into the concept of reproduction of the "key triad of sustainable development" of the circular economic and economic mechanism of society. The organizational foundations of this mechanism are formed by the following system-forming organizational predicates: a) the areas of institutional responsibility of corporate ESG management (at least the key triad); b) the basis of corporate ESG management - general and private; c) ways and tools to achieve sustainable ESG development for the implementation of the basics using corporate ESG management methods. The organizational essence of this concept in the context of systems theory and the paradigm of system dynamics is presented in the system diagram of Figure 1.

Figure 1 shows that the general basis of corporate ESG management [sustainable corporate development] should be based on leadership and responsibility for ensuring the private bases of corporate ESG management [participation in the creation of an "Abundant
World”, "Honest World" and "Livable World"] (Figure 1). Private foundations, through joint efforts, contribute to the evolution of the key triad of sustainable development. Further, the system-forming organizational predicates of the key triad ("Economic development", "Social progress", "Environment") form additional growth factors for the general and private bases. All together, this becomes a circular platform for the development of the economic and economic mechanism.

From the above reasoning, it follows that the concept of sustainable development today has really moved from a highly specialized paradigm focused on the corporate sector (as it was at the stage of its formation) into a phase of active growth and qualitative transformations. As a result, it should be concluded that it is steadily turning into a metaconception. This is quite consistent with the current historical moment, which consists in the transition of mankind to a new evolutionary track – the era of an integral cyberinformation society.

**Regulation 2. The fundamental principles of the organization of the university model 4.0 to achieve a new quality of the management corps**

Currently, various countries are faced with an urgent need to increase the level of efficiency in general based on the development of transformative manager intelligence. The need is due to the need for highly effective, creative, often non-standard, innovative and breakthrough (to use the terminology of innovation theory) management solutions for conducting the philosophy of leadership and institutional responsibility in the paradigm of sustainable development [19], [20].

Therefore, the task of developing the transformative intelligence of a manager can and should be solved within a scientific and technological collaboration of the type "University-Research organization-Industry" [24, 25]. This collaboration is able to demand new qualities of a manager, provide resources for the transition from the university 3.0 model to the University 4.0 model with elements of Industry 5.0 and ESG for the development of cybersocial digital ecosystems. The organizational platform of the University 4.0 is currently not fully defined. However, it is already obvious that this is an "intelligent", "digital" university that supports interdisciplinary and multidisciplinary collaborations in the interests of research and the formation of project teams, as well as innovative teams.

In order to form a new quality of the management corps, the organizational platform of the university 4.0 should be formed on the principles of "scientific" and self-increasing educational value.

**THE FUNDAMENTAL PRINCIPLE OF SCIENTIFIC KNOWLEDGE.** The concept of a "smart university" should be based on the principle of "scientific organization of scientific and educational activities of the university." Further abbreviated as "the principle of science".

In addition to being scientific in purely scientific and educational matters (actual scientific activity and scientific relevance of methodological materials), this principle presupposes the scientific organization of the actual scientific and educational platform of the university 4.0. Including this:

1) digitalization and intellectualization of: a) the scientific and educational space of business communications; methods of storing and transmitting data; b) the processes of developing new scientific knowledge, mechanisms for organizing educational and research processes, etc.

2) permanent generation of scientific knowledge by the efforts of teachers and research students, during which: a) new scientific knowledge is developed and immediately organically integrated into the general context of domestic and world science; b) the professional research value and competence of teachers increases; c) research students are formed on new scientific knowledge; c) scientific and educational platforms are being enriched.
3) extensive collaboration of research and educational activities with other universities, industrial corporations and research institutes to improve the quality and effectiveness of the scientific and educational sphere of the state as a whole.

4) the development of the university on the basis of a philosophical understanding of its educational activities and the implementation of the conceptual tasks that the philosophy of education poses to the scientific and educational sphere [19], [20].

The principle of scientific approach to the university 4.0 is the fundamental organizational principle of permanent improvement of the scientific and educational quality of the taught disciplines and basic educational programs (BEP).


Another fundamental organizational principle is the principle of the self-growing value of the university 4.0. The essence of the principle is that the quality of the organization of scientific and educational activities of the university should constantly "self-grow". The self-growth of the quality of an organization, according to its growth models, is largely similar to eco- and bioevolutionary development processes. For example, the soil is formed due to the adsorption of fallen leaves and grasses, species are transformed due to the appearance of successful phenotypic and genotypic changes in current generations and their consolidation in subsequent generations.

Therefore, research and teaching activities should be considered not only as a current phenomenon that gives a situational result, but also as an "investment contribution", an "investment flow" into the future. In this regard, there should be a demand for a high level of quality of the organization: scientific research at the university 4.0, forms and methods of converting scientific results into scientific and information content; scientific and educational research at the University 4.0 in terms of the methodology of converting scientific information into educational and training; scientific and scientific-methodical growth of the teaching staff, the formation of professional "research teachers" of the 4.0 university; the quality of scientific and scientific-educational work of "research students" studying at the 4.0 university.

Investment contributions and investment flows through each teaching cycle should "return" with a new higher quality of the university's intellectual capital 4.0. Namely, these are: new scientific achievements of specific research teachers, a higher scientific level of teachers in general; updating scientific knowledge; new educational methodology and new teaching materials for research students based on the latest scientific achievements; new methods and tools of cognition that allow you to master scientific and educational tracks more efficiently.

Regulation 3. Formation of the educational value chain of the University of the 4.0 model (development for economic and managerial educational specializations)

The University of the 4.0 model with elements of Industry 5.0 and ESG for the development of cybersocial digital ecosystems is a meta–system, the organizational core of which is the integrated chain of creation of scientific and educational value, which is shown in Figure 2 (abbreviated as "CCSEV").

The CCSEV includes the following six core business – "CB":

CB-1: Activities for the generation of new scientific and technological knowledge (abbreviated as "STK"). Generation is implemented mainly through the efforts of its own core staff (teaching staff – abbreviated "TS") with the partner role of invited TS, as well as with the supporting role of students, undergraduates and graduate students. The generated STK is a special product and, at the same time, a resource of the university 4.0. The new STK, as the output of CB-1, is always world–class knowledge, presented in an extremely concentrated form of scientific novelty and scientific and practical significance.
CB-2. The new STK received by the University 4.0 (in the form of scientific novelty and scientific and practical significance) is integrated into the general context of the development of science, technology and technology through the efforts of TS University 4.0. At the output of CB-2, the University 4.0 receives "Basic scientific and technological content" (abbreviated as "BSTC").

BSTC is a special product and, at the same time, a 4.0 university resource. It is necessary for: a) promoting the next wave of scientific and technological development of society; b) subsequent transformation of BSTC into "Scientific and educational content" (abbreviated as "SEC").

CB-3. This core business is responsible for the formation of the SEC based on the BSC. SEC is the only legitimate basis for: a) the development of a fundamental, relevant theoretical, methodological and methodological basis for teaching students, undergraduates and postgraduates; b) the formation of a methodology and teaching methodology taking into account the specifics of disciplines and basic educational programs (abbreviated as "MEP"); c) the development of principles and approaches to the organization of training. All together, points a), b) and c) are a legitimate basis for developing requirements for the organization of the scientific and educational sphere of the university 4.0 and the formation of SEP.

CB-4. By this core business, the SEC is transformed into a scientific and educational platform (abbreviated as "SEP"). The following tasks are being solved within the framework of SEP: a) the requirements for material, organizational, financial and information support for university science and research, scientific and innovative collaborations are being determined; b) the organizational core of the system of educational programs and individual educational tracks for students of the University 4.0 is being formed.; c) the optimal set of tools for a specific educational process, for contact and contactless work with students and other students, etc., is finally being formed.

CB-5. The listed tasks of paragraph 4 (a; b; c, etc.) provide the basis for theoretical understanding and methodological elaboration of the educational process (abbreviated as "SPM"). The educational process should be adapted on a scientific and pedagogical basis to the psycho-physical capabilities of students, the specifics of the knowledge received by the student, the necessary amounts of information assimilation.

CB-6. Core business 1-5 serve as the institutional and organizational basis for the qualitative implementation of type 6 – educational activities.

In general, activities 1-6 are the core business that define the elements of the CCSEV University 4.0 model with elements of Industry 5.0 and ESG for the development of cybersocial digital ecosystems.

As an example, Figure 2 shows the CCSEV model developed for economic and managerial educational specializations.

In conclusion, it should be noted that CSV was developed in the methodology of the system paradigm, which is the reason to consider it a largely universal tool. This means that it can be adapted for other educational areas of the Russian University 4.0.

4 Discussion

The developments presented in the article can serve as a conceptual basis for the formation of projects and/or programs for the transition of the Russian university community to the 4.0 model with elements of Industry 5.0 and ESG for the development of cybersocial digital ecosystems. In order to deepen research and qualitative design of projects/programs in this area, research should be conducted in an organizational and systemic paradigm, in the context of the principles of system dynamics on an interdisciplinary basis. This implies two
conditionally opposite research trajectories - "from above" research" and "from below" research.

"From above" research" is research tasks that need to be solved in order to determine the intra-organizational and intra-institutional requirements for the university 4.0 model and its limitations. The external environment and external factors are natural constraints on both the organizational boundaries of the university system and the fairway of its changes. The conceptual tasks of research in this direction, for example, are given in Table 1.

"From below" research is the tasks necessary to define and scientifically specify the internal organization of the University 4.0. To a large extent, this project is devoted to the formulation of this set of tasks.

Fig. 2. The main activities of the chain of creation of scientific and educational value [CCSEV] of the University 4.0 of Russia (developed by the authors for economic and managerial disciplines)

5 Conclusions

The sustainable ESG development of the state critically depends on the timely modernization of the organizational mechanisms of the scientific and educational sphere of society. In this regard, it should be noted that today there is an urgent objective need to conduct research in the field of scientific organization of the transition to the university of the 4.0 model with elements of Industry 5.0 and ESG for the development of cybersocial digital ecosystems.

Thus, within the framework of the research, the concept of the scientific and educational mechanism of the University 4.0 with elements of Industry 5.0 has been developed to ensure sustainable ESG economic development, reflecting the following results.

1) a scientific and theoretical position has been developed on the objective contradiction of the development of scientific and technological knowledge of society, which determines the need for universities to switch to the 4.0 model with elements of Industry 5.0 and ESG for the development of cybersocial digital ecosystems;

2) the principles of scientific and self-growing scientific and educational value of the university of the 4.0 model with elements of Industry 5.0 and ESG for the development of cybersocial digital ecosystems are substantiated;
3) a chain of creation of scientific and educational value by the university 4.0 with elements of Industry 5.0 and ESG for the development of cybersocial digital ecosystems has been developed (using the example of management disciplines for the economic and economic sphere).

The authors note that this study is a small contribution to solving a large-scale task – preparing the transition of the scientific and educational sphere to a 4.0 university, to a "smart university" based on the principles of Industry 5.0 within the framework of sustainable ESG economic development in order to train modern personnel meeting global challenges and processes of digital transformation in the economy and industry.

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