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*Cognitive modeling and management decision making in poorly structured systems.
(Fuzzy cognitive modeling)*

Artificial intelligence systems and technologies.

Robotics; Digital Economy.

INDUSTRY 4.0.; Industrial Internet of Things ("IoT" for I).

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Dear Readers and Authors of Journal!

With great pleasure we are presenting the first issue of the peer-reviewed scientific and practical journal “ACCESS”. Scientific edition “ACCESS: Access to science, business, innovation in digital economy” is an international electronic scientific and practical journal on economic sciences, founded in 2020 by the ACCESS publishing house.

In modern conditions of instability, systematic crises and global transformations, the problem of developing methods and technologies for analysis, modeling, management, forecasting and decision making for stable development of viable socioeconomic systems has become the most important.

The basic subjects of the electronic journal are dedicated to authors' research and development, concerning theoretical and applied questions of economy development, national, regional and local social, economic, ecological, and information systems, their integration into the world economy, setting up business environment and new forms of enterprise, introduction of economic innovations, as well as other fields and topics related to social sciences, such as computer and information security, which in their entirety provide theoretical, practical, theoretical-practical knowledge, methodological perspectives of those fields and topics of scientific knowledge, as well as impact and social applications of science and technology.

The main goal of the electronic scientific journal “ACCESS” is to join the efforts of researchers, who work at scientific and educational institutions to improve the quality of economic research and education. The formation of a knowledge-based society is accompanied by an increase in the importance of human resources; general expansion of information systems and technologies in all aspects of life; irresistible globalization; the realization of the values of entrepreneurship; identifying and realizing opportunities for creating economic, social, cultural and personal sustainability, openness and accessibility through new ventures in business, government and society.

We aim at providing the best platform out there, where educational organizations, universities, scientists can publish their journals and make sure they are compliant with the requirements of Scopus and follow the Open Access policy, while still being modern and beautiful. It will provide a forum for generating new ideas that can be turned into experiments and sustainable implementation in the form of new activities and new endeavors.

We hope you will support us in this endeavour to a sustainable future.

I'd like to thank the authors who present scientific articles of both theoretical and empirical content, representing scientific and practical interest in all areas of economic science.

I am grateful to the members of the editorial board for their undeniable competence, commitment and gratuitous work to create and promote a network of scientific communities in the profile of the journal and to promote research! I am also grateful to the reviewers for the analytical and well-intentioned motivating reviews!

I express my special gratitude to the co-founders and members of the editorial board, who accepted the invitation to work together and contribute to the creation of the international scientific journal “ACCESS: Access to science-business-innovation in digital economy”.

With best regards,

Editor-in-Chief

Mariana PETROVA

D.Sc. in Physics and Mathematics

St. Cyril and St. Methodius University of Veliko Tarnovo, Bulgaria

Dear Readers and Authors of Journal!

Let me congratulate all the readers of this first edition of the ACCESS Journal.

Over the last years, the world has undergone major geopolitical, economic and social changes. The modern paradigm of the global community's transition from a systemic crisis and the transition to a secure and sustainable development is, first and foremost, an innovative way of development based on modern innovative, information and convergent technologies, based on new knowledge as the main resources of development, based on socio-humanitarian technologies, as well as on the basis of active transition according to the 6th, and then to the 7th technological way of development and "Industry 4.0".

The concept of «Production Systems of the Future» and the Product Life Cycle (Interconnection): 1-Product, 2- Planning, 3- Product Design, 4- Production Planning, 5- Ramp Up, 6- Production, 7- Use of Product, 8- Service.

Some urgent problems of designing promising and resilient control and forecasting systems in an unstable environment: analysis and synthesis of systems of the type:

“X”- type systems, Integrated Models, Models of the "NMSSD" Type, Systems of the Type "SEEHS", Converged technologies: NBIC and NBIC + SH - technologies, Industry 4.0., Digitalization: DE, E-government, etc.

Green Technologies and the Green Economy (“greening”), Intellectualization, Smart Technologies (“Smart Technologies”) and Innovative Technologies. Innovative economy and innovative society of the future. "Society 5.0". Hybrid models and systems. Hybridization of the world: "RW + VW".

The general scheme of sustainable and socio-humanitarian development integral model of global (world) system, which the authors call the noosphere model of development, can be represented as an integrator:

$$S = \langle E_c, E_n, S_o, H_u; ESIT \rangle \quad \text{or} \quad S = E_c \oplus E_n \oplus S_o \oplus H_u \oplus ESIT$$

Today, the most important scientific, technical and technological problem is the design and implementation of complex systems with the desired properties based on Integrated systems such as "SEEHS" and Converged technologies such as NBIC and, in particular,

NBIC + SH, i.e. Integrated intelligent and hybrid systems such as

$$[S = \langle E_c, E_n, S_o, H_u; ESIT \rangle] \cup [\text{NBIC} + \text{SH}].$$

Necessary properties of the designed integrated and hybrid systems and technologies:

- o Integrality and intellectuality (systems type "X");
- o Sustainable and safe development; sustainable and biologically sustainable development;
- o The possibility and accessibility of assessing and predicting unstable situations (crises, epidemics, disasters, and other critical events.);
- o Innovation and smart technologies;
- o Hybridization (RW + VW) - digitalization and virtualization;
- o Green (Green) - technology (or "Clean" technology; "greening").

The solution to this problem can be implemented only on the basis of systemic, synergetic and interdisciplinary studies, i.e. the wills of multidisciplinary and multidisciplinary scientists.

Mankind is facing the biggest challenge during its existence. Humanity enters into "Industry 4.0" (Schwab, 2016), where the physical world is connected to the virtual world. Information technology, telecommunications and production are merging, and at the same time, the means of production are becoming more independent. It is still impossible to say exactly what the "smart factories" of the future will look like.

Scientists from all over the world and specialists from all scientific fields are called upon to find answers to thousands of challenges of the new world in the conditions of Industry 4.0 and the digital economy. The term "digital economy" appeared in the scientific literature not so long ago, at the end of the 20th century, and became widespread. Digital technologies at the beginning of the XXI century, are developing rapidly and have a major impact not only on the economy, but also on the development of society.

The favorites of "Industry 4.0" will be biotechnology, nanotechnology, robotics and mechatronics, new medicine and new environmental management, development and use of personality and team capabilities at a new, higher level. About development, reforms, modernization, innovative technologies and what the world is transitioning today, moving to the sixth technological way, that is, to the NBIC (*nanotechnology, biotechnology, information technology, cognitive technologies*). And socio-humanitarian technologies (SHT) refer to a person, to practice, to society ... to of moral, morality, to of culture. And this is more of a philosophical problem. That is, now we have to focus on NBIC + SH - technology. From here it is clear which executives we need, what personnel we need to prepare. Yes, those who can organize and secure this breakthrough in the future.

We are on the threshold of a new revival in science and technology, based on a comprehensive understanding of the structure and behavior of matter from the nanoscale to the most complex of open systems, the human brain. The unification of science, based on the unity of nature and its holistic study, will lead to technological convergence and a more effective social structure to achieve human goals. The phrase "convergent technologies" refers to a synergistic combination of the four major "NBIC" (*nano-bio-info-cogni*) fields of science and technology, each of which is currently progressing rapidly.

Thus, on the basis of a synergistic approach, the issue of exacerbation of global crises generated by technogenic civilization is considered, and the question arises: is it possible to overcome these crises without changing the basic system of values of technogenic culture? This value system will have to change that overcoming global crises will require a change in the goals of human activity and its ethical regulations. *Humanity has a chance to find a way out of global crises, but it will have to go through an era of spiritual reformation and the development of a new value system.*

HYBRID NONLINEAR WORLD – HNW

(symbolism of the development of the modern complex nonlinear world)

**Real / Physical
World: (R / W)**

**Virtual / Digital or
E-world:
(VW / DW or EW)**

**CONTINUITY
(Cycle / Fractality)**

The hybrid world is integration and merger / acquisition

Physical and Virtual Worlds:

HW:=PhW & VW → INDUSTRY - 4.0 & DE

The main objective of the present volume is to analyze and to identify the contemporary challenges facing development in the context of the priorities of sustainable development, intelligent and inclusive growth; to outline and to present good practices, to investigate and to propose new tools and recommendations for future development.

The first volume of the journal is presented in a completed form, fulfilling the intended objective and related tasks, but poses many questions and ideas for future scientific research. It can be used by a wide range of users - in the scientific work of collective monograph researchers and academics, in the training of students, in the work of state institutions and non-governmental organizations, etc.

Special acknowledgments should also be rendered to the publishing house “ACCESS”, Bulgaria which made the journal true and assisted its publishing.

We hope that through the involvement of academics and practitioners from many institutions of high international standing as well as through the peer review process the editors will be able to ensure continuous high standard of this journal.

I hope that the publishers will find ways to reach wider audience.

With best regards,

Chairman of the Scientific Council

Sultan RAMAZANOV

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DEVELOPMENT MANAGEMENT AND FORECASTING IN A GREEN INNOVATIVE ECONOMY BASED ON THE INTEGRAL DYNAMICS MODEL IN THE CONDITIONS OF "INDUSTRY - 4.0"

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"Linear thinking is useless in a non-linear world"

ABSTRACT

In modern conditions of instability, systematic crises and global transformations the problem of developing methods and technologies for analysis, modeling, management, forecasting and decision making for stable development of viable socioeconomic systems has become the most important. These systems are characterized by complex structure and behavior, the synergism and non-linearity and have all sorts of "NOT" and "MANY" factors characteristics. The study of model's systems, which include in their structure the humanitarian component (socio-ecological, economic and humanitarian subsystems – SEEHS, i.e. it is aspect of integration of 4 spheres) as a system of the noosphere type, is very actual problem. The green innovations economics in the conditions of "Industry - 4.0", such as man-made integral industrial systems, are systems of type SEEHS. The peculiarity of the processes of stable development management, prediction and managed decision-making in the modern conditions of socio-economic, ecological, social and humanitarian crises, and the system crisis as a whole, as well as in the conditions of necessity and importance of stable and safe development of industrially of economic structures consists in accounting of the influence of uncertainties as on the object of control as well as on behavior of decision-makers. There has been proposed models and control technologies of viable, stable and safe development of SEEHS systems based on the integrated "object and subject" oriented approach, a conceptual model, a generalized model of the synergistic dynamics with the regard of the uncertainties of on both stochastic and chaotic factors, of on base nonlinear dynamic and others.

Key words: integral, model, development, management, prediction, innovations economics.

JEL classification: C02; Q01; Q57

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INTRODUCTION

The main scientific and technological driving factors in the 21st century will be innovation development following super technologies: Artificial Intelligence, Nano-Technology, Bio-Media Technology, Cognitive technology and Socio-Humanitarian technology. More specifically, this is the modern development of Innovative Technologies: «NBIC» + «SHT» or NBICS- convergence.

Technology convergence is a functional / integrator of «NBIC+SH» – technologies. NBICS- convergence is a technology integrator (Ramazanov & Burbelo & Vitlinsky et al, 2012), i.e. functional aggregator, which

is based on synergistic and systemic synthesis and structural implementation. Each of the components of convergence (integrator) is positioned as a subsystem / component with its corresponding function, potential and scope. NBICS is integration: *Nano-*, *Bio-*, *Info-*, *Cogno-* and *Socio-* - subsystems. The structural structure of society is the functional basis of its self-organization. Actual examples of social aggregation are the institutions of education and health care, which function effectively both offline and in the context of convergence of common tasks. Thus, NBICS - convergence as a functional integrator works as a single system with five main subsystems. Substrate, synthesizing, distributive, cognitive and social aggregation stimulate synergistic manifestations of convergence. At the same time, manufacturability, the ability of the subsystem to work as an appropriate technology (for example, nanotechnology, information technology, etc.) are also important. In general, the NBICS integrated model is aimed at a unified system support for the efficient operation of systems based on NBICS- convergence. In addition, through the sociocomponent, a paradigm link is established between natural-scientific and social-humanitarian knowledge. However, a more accurate integration is NBIC + SH (Ramazanov et al., 2019). Since complex technical, socio-economic, ecologic and social processes are generally non-linear, they are often unstable. In studying nonlinear systems, the researcher is often interested not so much in the time of development of the corresponding instabilities as in the time of evolution or development of unstable systems, that is, the time of arrival of the system, after all, to some limit state. The limiting state of the system often has attracting properties called attractors.

When studying complex nonlinear systems, to understand a very complex process, one sometimes chooses a very simple system from any field whose behavior is similar or qualitatively resembles the behavior of the system being studied. By studying the properties of a simple system, they find those general characteristics of behavior and inference that are almost independent of the details of the model, and these general conclusions are used to analyze the behavior of much more complex systems, transferring knowledge from one, simpler system to another, more complex. In addition, because in complex nonlinear systems there is a process of self-organization, it is possible to apply simple models and theories to complex nonlinear systems. However, it should be noted that in complex nonlinear systems there are many degrees of freedom, but in the process of development (evolution) can be distinguished by several defining measures of freedom, which are attached to all others. These defining measures of freedom of nonlinear systems are called order parameters. If these parameters are few, then it becomes possible to describe a complex system relatively simply.

Synergetics, or self-organization of complex systems, relies on the nonlinearity, openness and dissipation of systems. Nonlinear open dissipative systems are assumed to underlie most complex biological, social, technical, physical, and other phenomena. Today, humanity is aware of the threat posed by natural disasters, natural and man-made disasters, conflicts in society, wars and the like. To prevent natural disasters, catastrophes, conflicts, wars, and other emergencies, the potential of modern science must be harnessed. It is necessary to create an international approach to the problem, which can be called risk theory, on the basis of

which risk management is possible. Today, there is an urgent need in the world to anticipate and mitigate emergencies. The task is to create a new paradigm in the field of hazard or risk management, and to construct a mathematical theory of safety and risk based on nonlinear dynamics and computer simulation. On the basis of systematic analysis and nonlinear dynamics, patterns of catastrophic behavior of most complex systems in the field of technosphere, economy and the like can be revealed.

Nonlinearity, synergetics, crisis. Comparing the major technologies of the XX and XXI centuries, we see a fundamentally important new element. Strategic objectives of the XX century were solved by the use of technologies based on the knowledge of physics, chemistry, mathematics, mechanics, computer science.

New technologies are interdisciplinary. They require, on the one hand, knowledge of man and rely, of course, on knowledge of man. On the other hand, they present specific forecasting and design methods that imply quantitative description, the use of formalized models and methods of applied mathematics. On the other hand, they require a comprehensive description of the object, its relationship with the biosphere, technosphere, with scenarios of technological development. To do this, it is necessary to build on the solid foundation of science. One of the most successful and productive interdisciplinary approaches is self-organization theory or synergetics.

Synergetics considers so-called nonlinear and unstable systems. Nonlinearity means paradoxical, anti-intuitive behavior of objects (when the joint action of several causes or factors can give new quality, when the result of their action cannot be calculated as the sum of the results of these reasons separately), which are studied. Nonlinear systems are characterized by several development scenarios, several options for the future. Instability is characteristic of systems that are far from equilibrium, and means that small deviations in such systems can build up, moving the object being studied to another state.

Economic, social, structural, systemic and current crises in the past are one of the manifestations of the nonlinearity and instability of the respective systems. Therefore, it is natural to speak about them in the language of synergetics.

The idea that after the works of Kondratiev, Schumpeter and other authors in the theory of social development - economics, history and other sections - some theory of cycles emerges. It is too early to talk about the creation of such a theory - as long as there is only a description of the phenomenon of fractality (not of cyclicity, but of fractality). Often found, the particular role of cyclicity is premature. The most significant result of N. Kondratiev is probably proof of the ineligibility of direct linear extrapolation, even at the level of statistics; the economic process is a substantially non-linear phenomenon, moreover, it is a process of self-organization of a complex dynamic system. Kondratiev was able to identify the factor that determines the transition to the bifurcation state of one of the components of this process of conjuncture. Does not follow Kondratiev et al. the authors so indisputably talk about predictions based on "cyclicity". It can only be a forecast of trends and the possibility of anticipation of the crisis. Not more ! In times of crisis, memory of a complex nonlinear system sharply decreases and factors of a stochastic nature begin to play a special role; the post-crisis state is almost unpredictable (Ramazanov & Nagyón & Crystal & Stepanenko,

2009; Ramazanov & Rogoza & Musayeva, 2010; Ramazanov & Levasheva & Stepanenko et al., 2011; Ramazanov & Burbelo & Vitlinsky etc., 2012; Levashova, 2011B, Koval et al, 2019).

In order to increase the competitiveness of enterprises at the beginning of the second decade of the XXI century enhanced integration of «*cyber-physical systems*» (CPS) into factory processes has begun.

The era of the «Industry 4.0» concept has come. The «Industry 4.0» concept provides for the full digitalization of all physical assets and their integration into vertical and horizontal value chains. It also involves digitizing products and services and developing digital business models, as well as providing customer access. CPS is in high demand among multinational companies such as Siemens, Cisco, Thyssen Krupp, who benefit most from the «Industry 4.0» concept. At present, «Industry 4.0» is gradually taking over the whole world.

The favorites of "Industry 4.0" will be biotechnology, nanotechnology, robotics and mechatronics, new medicine and new environmental management, development and use of personality and team capabilities at a new, higher level. About development, reforms, modernization, innovative technologies and what the world is transitioning today, moving to the sixth technological way, that is, to the NBIC (*nano-, bio-, info- cogni-*) technologies (Ramazanov, 2018). And socio-humanitarian technologies (SHT) refer to a person, to practice, to society ... to of moral, morality, to of culture. And this is more of a philosophical problem. That is, now we have to focus on NBIC+SH – technology (NBIC+SHT). From here it is clear which executives we need, what personnel we need to prepare. We are on the threshold of a new revival in science and technology, based on a comprehensive understanding of the structure and behavior of matter from the nanoscale to the most complex of open systems, the human brain. The unification of science, based on the unity of nature and its holistic study, will lead to technological convergence and a more effective social structure to achieve human goals. The phrase "convergent technologies" refers to a synergistic combination of the four major "NBIC" (*nano-bio-info-cogni*) fields of science and technology, each of which is currently progressing rapidly.

Thus, on the basis of a synergistic approach, the issue of exacerbation of global crises generated by technogenic civilization is considered, and the question arises: is it possible to overcome these crises without changing the basic system of values of technogenic culture? This value system will have to change that overcoming global crises will require a change in the goals of human activity and its ethical regulations. *Humanity has a chance to find a way out of global crises, but it will have to go through an era of spiritual reformation and the development of a new value system.*

The modern paradigm of the global community's transition from a systemic crisis and the transition to a secure and sustainable development is, first and foremost, an innovative way of development based on modern innovative, information and convergent technologies, based on new knowledge as the main resources of development, based on socio-humanitarian technologies, as well as on the basis of active transition according to the 6th, and then to the 7th technological way of development and "Industry 4.0".

The modern vector of civilizational sustainable development of society requires the intensive implementation and dissemination of global technologies: nano-, bio-, information and communication technologies and convergent technologies, as well as the development of socio-humanitarian technologies. (Arshinov & Budanov, 2016; Chuprov, 2012; Roco & Bainbridge & Tonn etc.; Babkina, 2017; Melnyk, 2017; Kapitsa, 2018; Ramazanova et al, 2019; Kovalchuk & Naraikin & Yatsishina, 2013; Lecturer, 2011; Melnyk, 2015; Kazantsev & Kiselev & Rubvalter & Rudensky, 2012; Levashova, 2011A, Gryshova, 2019).

Note that cognitive technologies are global-level technologies, the transforming effect of which gives a new quality to interacting elements and leads to the formation of a fundamentally new technological platform for sustainable economic development. The increase in the intellectualization of industrial production contributes to the fact that the distinguishing features of enterprises are: significant individualization of products in the conditions of high flexibility of large-scale production; the integration of consumers and manufacturers in the framework of end-to-end processes throughout the product life cycle and value chain; integration within the framework of production networks of information and data reflecting all aspects of requirements, design, development, production, logistics, operation, service, etc., i.e the creation of "industrial intelligence"; globalization of product / product development teams, as complexity of products requires a variety of competencies; the formation of a network production "ecosystem" due to cooperation and lowering barriers between enterprises and customers; the development of "cloud" technologies as a way to implement customized production by order; use of production capabilities of virtual production networks on the basis of integrated production sites, their support with special software; isolation and accumulation of non-material functions, such as research and forecasting of the market and demand, formation of a product concept, formation of technical requirements, etc.; because non-material components occupy an increasing share in the cost and price of the finished product; the formation of the market value of enterprises through the knowledge of employees, know-how, high technology, inventions, industrial designs and other intangible assets.

A qualitative change in factors of production puts forward a set of interrelated tasks for industrial enterprises: integration into «Industry 4.0», increasing the continuity and flexibility of production, transition to flexible production systems that ensure the adaptation of production infrastructure to innovative activities, changing market requirements requires different approaches to the composition and configuration of key production factors; increasing the consistency in the duration and productivity of all interconnected divisions of industrial enterprises causes the recording of results not only at the place of application of production factors, but also in related divisions from the position of their influence on the economic performance of enterprises; a rational increase in the growth of R&D costs, which ensures the implementation of scientific and technical policies directly in the process of scientific and industrial activity, determines the assessment of their relationship with the share of revenue from new types of products; the uncertainty of the economic situation, high risks in the development of innovative products create the prerequisites for the development

of economic and mathematical models that are adequate to the object of study and can improve the quality of industrial enterprises.

Thus, the steady economic growth of modern industrial enterprises is determined not so much by the number of personnel as the presence of workers who are able to carry out scientific and technological developments at the modern level, create competitive products and services based on them, offer new ways of organizing production, and determine the formation of new technological trends development in a market environment. In this regard, a different system of productive forces is needed that exceeds the capabilities of the industrial type of production and other ways of combining living and materialized labor.

The convergence of intellectual resources and information technology as a productive force leads to the emergence of new types of factors of production - cognitive factors of production - which are understood as specific, hard-to-simulate resources of an industrial enterprise that allow you to create a product that is in demand on the market. Connectiveness as a scientific and cognitive action is moving into a new quality, providing the appropriate knowledge for complex research.

Artificial intelligence, neurocomputers, technologies of various interfaces based on the use of the properties of the human brain is a fundamentally new environment for human production. The use of cognitive principles in the economy allows us to bring the basic production processes to an intellectually new level.

«*Green technologies*» and «*Green economics*». Nowadays, the spread of digital technologies: 3D modeling, 3D scanning, volume printing and robotics, as well as artificial intelligence systems and technologies has become a powerful factor that has given a new impetus to progress towards the growing needs of mankind. But in order for an innovative product to organically fit into the multidimensional space of the future, at the present stage of development of society, the environmental component of any innovation comes to the fore, that is, innovation, among other things, must be environmentally acceptable. According to many experts, environmental technologies, colloquially called "green technologies", will become leaders in the development of the world economy in the 21st century. Expert opinions did not appear from scratch - in recent years, in the context of the implementation of the environmentally-oriented growth strategy, "green technologies" in the civilized world are developing at an accelerated pace and the answer to this challenge has been a new scientific direction and practice called "green technologies".

It is worth noting that there is no single definition of the concept of "green" or environmentally friendly technologies. The general approach implies the achievement of their main goal - to reduce the negative impact on the environment by reducing the amount of resources consumed, reducing the amount of waste up to their full return to production through deep processing, using models, technologies and principles in production processes, especially nature-like tools to increase quality and environmental safety.

"Green technologies" essentially cover all areas of human activity and are aimed at: sustainable development of modern society for the benefit of future generations with the solution of global problems, preventing the depletion of resources, establishing sound environmental management, improving

demography, eliminating toxicity of production; maximum waste reduction due to innovations in technology and consumption patterns; fundamental modification of hazardous industries and their replacement with harmless ones using natural technologies created by nature; replacement of non-renewable natural resources with alternative renewable sources of raw materials and energy; the exclusion of the use of harmful synthetic chemicals in agriculture, the introduction of biotechnology in agriculture, animal husbandry and the processing of agricultural products.

Currently, “green technologies” are being introduced into the entire chain of companies, including, in addition to production, consumption, management and methods of organizing production, in the name of solving global problems for the sustainable development of modern and future society, namely: modification and replacement of harmful industries; development of new alternative types of energy and new types of fuel; the search for new approaches to safe and affordable food and water; protection against pollution of the atmosphere, soil, fresh water and the oceans; prudent regulation of demography.

“Green technologies” is a vivid manifestation of the current trend in the effectiveness of an interdisciplinary approach to solving complex problems. They do not replace, but combine ecology, economics, social technology, based on all modern achievements of science and technology. Therefore, one of the most important areas of modern development of scientific and technological progress is a paradigm shift: from extensive to sustainable development. The most pressing global environmental problems today include climate change, access to quality water and other resources, loss of biodiversity, so we can assume that the development of technologies will be aimed at solving them. “Green technologies” are both environmentally friendly raw materials, and environmentally friendly end products, and environmentally friendly production.

Humanity has come to the point where modern civilization, called technogenically-consumer, has become deadlocked when it is necessary to seriously examine its grounds and consciously choose an innovative, socio-environmental, spiritual-moral and socio-humanitarian development strategy; otherwise, humanity may disappear from Earth as a result of today's global and systemic crises and catastrophes. The evolution of humanity as a global system, like the evolution of any open nonequilibrium system, obeys the laws of nonlinear dynamics and synergetics (Schwab, 2016; Kapitsa, 2018; Ramazanov, 2018; Ramazanov& Burbelo & Vitlinsky etc., 2012).

The merger of artificial intelligence, robotics, the Internet of Things (IoT), autonomous vehicles, 3-D printing, blockchain, biotechnology is driving the fourth industrial revolution, that is, «Industry 4.0».

The digital economy has created an enabling environment for the introduction of «Industry 4.0» as a new level of production organization and value chain management throughout the life cycle of products.

The modern paradigm of the world community's exit from the systemic crisis and the transition to safe and sustainable development is, first and foremost, an innovative way of development based on modern innovative, information and convergent technologies, based on new knowledge as the main resources of

development, based on socio-humanitarian technologies, as well as on the basis of active transition according to the 6th and then to the 7th technological way developmental and «Industry 4.0».

In today's difficult conditions and with the development of the modern economy, there is a need to consider the problems of its forecasting in a new way. This is due to the growing impact of the globalization processes and factors of uncertainty and risk on the economy and the performance of individual countries and regions. Existing methods and forecasting models rely heavily on the use of econometric models; Particular importance is forecasting on the basis of random processes, including within the framework of stochastic dynamic models of general equilibrium. These stochastic models of economic growth are based on the growth paradigm, which greatly reduces the possibilities of their application in the conditions of a change or a change in the trend of economic development. Nowadays, the increasing influence of current risk factors on the state of the economy and society is observed, which generates a violation of its relative stability and leads to a significant reduction of the influence of factors and conditions of past years on the trends of economic development in the long run.

This paper analyzes the possibilities of forecasting development based on the approximation of the integral stochastic growth model in the form of recurrent equations, which are formed taking into account the properties of the increments of the Wiener random processes. It takes into account only the current or initial state of the economy (Ramazanov & Stemplewska, 2017).

We note that for simulating economic growth, initially, similar deterministic ratios were used. Later, the staging of growth models was associated with the introduction of various shock variables taken into account in the form of random processes. Due to the complexity of the methodological, mathematical, informational nature, an integrated model of sustainable development of the socio-ecological-economic system has not yet been created, suitable for all levels of governance. Therefore, only the creation and integration of various econometric, balance and optimization models, as well as models of nonlinear dynamics and neural network modeling into a single system give an opportunity to comprehensively describe the interconnections and trends of the development of the whole global system in the conditions of market and mixed economic relations. Only the integration of socio-economic, ecological, cultural-spiritual, and other processes modeling methods will ensure the stability and viability of the whole system (Ramazanov&Sergienko, 2014; Ramazanov, 2015; Ramazanov, 2008; Ramazanov et al, 2012).

In today's difficult conditions of nonlinearity, instability and systemic crises the increasingly decisive role in the growth of the national economy is given by the achievements of science, technology and education embodied in innovation. It is innovations, as the decisive result of scientific and technological progress, stimulate the growth of productivity and efficiency of the use of factors of production, improving the quality and competitiveness of the country's products. From the middle of the twentieth century the government of the leading countries of the world, which belong to the developed countries of the world, took an open course on innovation, creating an innovative economy, combining the intensification of scientific and

technological progress (STP) with institutional transformations in the economy and the public administration, aimed at improving the quality of organization and management of the economic system.

Scientific and technological progress as a continuous and systematic process of introducing into the economic practice the results of the development of science and technology, as well as new methods of organization of production and labor affects economic growth and development in several ways: first, the improvement of technologies allows you to increase the gross output without changing the aggregate costs; and secondly, the technological transformations of production lead to a change in the structure of products produced in favor of high-quality goods and services with high added value; Thirdly, STP causes major changes in objects and means of labor; Finally, STP makes a significant contribution to improving the well-being of society and the quality of life of the population.

However, in the simulation of ecological and economic development in line with the concept of environmental modernization and the principle of sustainable development, the following interconnected systems must be taken into account: economics (production), labor (population), resources (minerals, natural resources, etc.), nature (this system reflects the state of the environment), and it is also important to take into account the achievements of the STP and the level of education.

Consequently, the development and research of integrated stochastic models based on the use of mathematical methods, models and innovative technologies in order to predict the nonlinear stochastic dynamics of ecological-economic and social-humanitarian systems in the current conditions of uncertainty and risks is an urgent problem (Vagapova, 2007; Galitsin & Ramazanov, 2017; Grigorkiv, 1999).

The purpose of the work.

The problem of modeling, forecasting, optimal stochastic management/control and decision-making in socio-ecological-economic systems with humanitarian components, i.e on the basis of integration of 4 spheres of activity and functioning of modern complex systems in the innovative economy (represented both in phase space and in space ESTI ("education - science - technology - innovation"), as well as in modern science in general, is the main and relevant. The purpose of this work is to develop and study the integral socio - ecological - economic stochastic nonlinear model of the dynamics of technogenic objects and processes for forecasting the development of a green innovative economy. The proposed work is a development of recent studies by the authors. (Ramazanov & Stepanenko & Chernyak & Tishkov, 2019; Ramazanov & Stepanenko & Tishkov & Honcharenko, 2019).

Presentation of the main results.

In this work, technogenic objects and processes (TOP) refer to man-made industrial enterprises or technogenic regional production (TRP), or technogenic regions (TR), technogenic economic object (TEO), and others like that. We will devote all this as TOP. The review and analysis of some recent results obtained by various authors on macro- and micro-modeling of the dynamics of ecological-economic and social-humanitarian systems (SEEHS) and processes that are related to the TOP, are functioning and developing under difficult conditions of nonlinearity, instability and crises. The conceptual model of the forecasting and

management of ecological and economic processes, as well as the statement of the problem of optimal ecological and economic forecasting and management in the presence of "NOT - and MANY - factors" are presented in the author's work (Ramazanov et al, 2012; Grigorkiv, 1999). It also proposes a generic multiplicative - additive stochastic model with chaotic dynamics.

Most models of socio-ecological-economic systems (SEES) that were created earlier have theoretical and deterministic character and are quite problematic in terms of adequacy and availability of information, new knowledge and technologies for their implementation. In this regard, the task of controlling technogenic regional production (TRP) in the context of a crisis causes the objective need to improve methods, models and information technologies based on stochastic equations for the management of the SEES. (Ramazanov, 2015; Ramazanov, 2008; Ramazanov et al, 2012)

A general conceptual integrated model is proposed, a generalized synergetic model of dynamics is considered taking into account various uncertainties (stochastic and chaotic components). To predict the state of the green innovation economy, an integrated stochastic nonlinear model of growth dynamics in the phase space has been developed and investigated. The paper also examines the aspects of optimizing the management of modern complex systems that function and develop in the current conditions of instability.

An innovative model of sustainable and safety development of societies and the world as a whole should be built because of an integral paradigm of socio-ecological-economic unity and socio-humanitarian technologies. The following system as "Creator-Man-Socio-Humanitarian-Ecological-Economic environment" is the object for system analysis studying, synthesis, innovative technologies of modeling and management. At the same time, a global goal to ensure the safe existence and sustainable development of the entire world civilization is the research and development of integral models of the entire system with the following orientation structure (Fig. 1).

Here SHS — Socio - Humanitarian System; PS - political system; IT/S - innovative technologies and synthesis; $R(t)$ — input effects on the system(resources, specified regulatory functions, conditions, time and other restrictions); $Y(t)$ is the integral output of the system(both "useful" and "harmful") (Ramazanov, 2012).

The concept of sustainable and safety development implies a change of the traditional economy paradigms, the humanization and ecologisation of its main principles, the search for common approaches and the consistency of concepts for the development of ecological and socio-economic systems. During recent years, a new interdisciplinary field of applied science has emerged it is an ecological economics. Ecological economics is a new field of research that deals with the relationship between natural ecosystems and socioeconomic systems in the broadest sense, relationships that are crucial for many current problems of humanity, as well as for building a sustainable and high-quality future.

Moreover, a very important problem is also the study of systems with integral properties, that is, systems that include socio and ecological economics and humanitarian subsystems (SEEHS) as systems of the future (noosphere type systems) in their structure. Local regional production systems such as technogenic industrial systems (TIS) are also SEEHS type systems.

Fig. 1. An integrated model of sustainable development of global system (society, world civilization)

Therefore, there is a need to develop and apply models, methods and approaches that, from a single methodological approach, would allow us to analyze the behavior of a complex system, build a model of its development, predict its state and, on the basis of the data obtained, formulate control influences to ensure that the desired goals are achieved given restrictions and criteria. Because of this, it is important to systematize, analyze and develop new analytical models, methods and approaches to assessing the state and behavior of complex nonlinear stochastic dynamic systems, as well as demonstrating the possibilities of using them to solve the problems of managing systems of various nature, including social, economic, environmental, political, etc., operating under uncertainty.

The concept of sustainable and secure development of the state as a whole and of individual regions allows to ensure stable and balanced development of four sectors of activity: economic, ecological, social and spiritual and moral unity on the basis of innovative socio-humanitarian technologies, combining principles of economic efficiency, social protection and environmental safety.

Today, the most important scientific, technical and technological problem is the design and implementation of complex systems with the desired properties based on Integrated systems such as "SEEHS" and Converged technologies such as NBIC and, in particular, NBIC+SH, i.e. Integrated intelligent and hybrid systems such as $[S = \langle E_c, E_n, S_o, H_u; ESIT \rangle] \cup [NBIC+SH]$.

The general scheme of the integration model of sustainable safe ecological, economic and socio-humanitarian development of the system can be represented as an integrator:

$$S = E_n \oplus E_c \oplus S_o \oplus H_u \oplus ESTI .$$

That is, as an integral "4-unit" system, and E_c - the economic subsystem (production), E_n - the ecosphere, S_o - the social sphere, H_u - the humanities, $ESTI$ - (education, science, technology, innovation) or, in particular, R&D (Fig. 2). (Ramazanov et al, 2009; Ramazanov, 2018; Ramazanov, 2019; Zerkalov, 2012; Zgurovsky&Statyukha, 2007).

Fig. 2. 4 unite/sphere integrated system development diagram. Noosphere model of sustainable safe development (NMSSD) in space ($ESTI, t$)

Stochastic model of system dynamics with control vector. The principle of system dynamics of stochastic processes or the method of system dynamics in the presence of exogenous and endogenous stochastic effects can be represented as a stochastic differential equation (SDE): $\dot{X}_j = F(X_j^+, X_j^-, W_{jt}, U_{jt})$, where W_{jt} is the standard Brownian motion; U_{jt} - control vector; $\sigma_j(X_j, t)$ - coefficient of variability (volatility) of growth. In particular, the stochastic equation of dynamics for j -th the factor (subsystem) can be represented as a differential equation:

$$\dot{X}_j = \alpha_j X_j^+ - \beta_j X_j^- + \sigma_j(X_j, t) dW_{jt} + b_{xj} U_{xj}(t).$$

The stochastic term $\sigma_j(X_j, t)$ in the equation describes the influence of exogenous random factors. When adopting the notion of continuous-noise white noise, the equation of stochastic dynamics can be represented

as: $\dot{x} = F(x, t) + \sigma(x, t)e(t) + b_x u_x(t)$, where $u_x(t)$ - control vector, $\{e(t), t \in T\}$ - white noise with continuous time.

To represent a stochastic nonlinear model of dynamics of a system in a discrete case, we can use the difference equation in the form (Ramazanov & Sergienko, 2014; Osterm, 1970; Pshikhopov, 2009):

$$x(t+1) = f(x(t), t) + w(x(t), t) + b_x u_x(t), \quad t \in T,$$

where f - conditional mean for $x(t+1)$ a given $x(t)$, and w - a random variable with zero mean. If the conditional distribution $w(t)$ for a given $x(t)$ is a normal law, then the model can be rewritten as:

$$x(t+1) = f(x(t), t) + \sigma(x(t), t)e(t) + b_x u_x(t), \quad t \in T,$$

where $\{e(t), t \in T\}$ - the sequence of independent equally distributed random variables with parameters (0, 1).

Stochastic logistic model of development:

$$\dot{X}_j = A_j X_j (X_j^0 - X_j) / X_j^0 + \sigma_j(X_j, t)e_j(t) + b_{xj} U_{xj}(t), \quad j = \overline{1, k},$$

where X_j^0, X_j - accordingly, the maximum possible and the current value of the investigated value, and X_j^0 does not depend on time, and $\{e_j(t), t \in T\}$ - white noise with continuous time, $\sigma_j(X_j, t)$ - the coefficient of volatility.

Integral model of dynamics with control

As a result of complex formalization, we obtain one of the variants of the integral socio-ecological-economic and innovation model of dynamics in the form of the following system of equations (1) - (12) (Galitsin & Ramazanov, 2017; Solovyov, 2009).

Model of systemic dynamics with control:

$$\frac{d}{dt} \Phi_j(\circ) = \alpha_j \Phi_j^+(\circ) - \beta_j \Phi_j^-(\circ) + \sigma_j(\Phi_j, t) dW_{jt} + b_j U_j(t). \quad (0)$$

Capital model:

$$\frac{d}{dt} [K(t)] + \alpha K(t) = I(t) - C(t) - D(t) - B(t) + \sigma_K(K, t)e_K(t) + b_{jK} U_{jK}(t), \quad K(0) = K_0. \quad (1)$$

Model of production function:

$$Y = F(K, L, R, e_Y(t)) = \left[\beta_1 K^{\frac{\delta-1}{\delta}} + \beta_2 L^{\frac{\delta-1}{\delta}} + \beta_3 R^{\frac{\delta-1}{\delta}} \right]^{\frac{\delta}{\delta-1}} + \sigma_Y(Y, t)e_Y(t), \quad (2)$$

Release model for three assets:

$$Y(t) = A \tau(t) \left[(1 - \alpha_K^1(t) - \alpha_K^2(t) - \alpha_K^3(t)) K(t) \right]^{\alpha_1} \left[(1 - \alpha_{L_2}^1(t) - \alpha_{L_2}^2(t)) L_2(t) \right]^{\alpha_2} + \sigma_Y(Y, t) e_Y(t), \quad (2^*)$$

The dynamics of all labor resources: $L(t) = L_1(t) + L_2(t)$, where $L_1(t)$ and $L_2(t)$ - respectively, the volume of skilled and unskilled labor resources,

$$\frac{d}{dt}[L(t)] - \gamma_L L(t) = -\gamma_Z Z(t) + \gamma_C C(t) + \sigma_L(L, t) e_L(t) + b_{jL} U_{jL}(t), \quad L(0) = L_0, \quad (3)$$

The equation of dynamics of natural resources:

$$\frac{d}{dt}[R(t)] - \gamma_R R(t) = \gamma_K K(t) - Y(t) - \gamma_L L(t) + \sigma_R(R, t) e_R(t) + b_{jR} U_{jR}(t), \quad R(0) = R, \quad (4)$$

or $\frac{d}{dt}[R(t)] - d(K(t), L(t), R(t)) = \gamma_K K(t) - \gamma_L L(t) - Y(t) + \sigma_R(R, t) e_R(t) + b_{jR} U_{jR}(t), \quad (4^*)$

Model of dynamics of total volume of pollution $Z(t)$:

$$\frac{d}{dt}[Z(t)] + g(Z(t)) = f^*(c, K, L, R)(1 - \eta c) + \sigma_Z(Z, t) e_Z(t) + b_Z U_Z(t), \quad Z(0) = Z_0,$$

$$\frac{d}{dt}[Z(t)] = Z^+ - Z^- \quad (5)$$

where, for example, an technogenic object (TO): $Z^+ = \mathcal{H}(k)$, $Z^- = \lambda(1 - \alpha - \beta)f(k) + \delta z$, but for a technogenic regional economy as a whole (in case of mutual independence of the TO):

$$Z^+ = \sum_1^n \gamma_i f_i(k_i), \quad Z^- = \lambda \sum_1^n (1 - \alpha_i - \beta_i) f_i(k_i) + \delta z.$$

Ecological index equation:

$$\begin{aligned} \frac{d}{dt}[z(t)] - \delta_z z(t) = E[\phi(t)]^{\nu_1} [\alpha_L^1(t) L(t)]^{\nu_2} [\alpha_K^2(t) K(t)]^{\nu_3} + \\ + \sigma_z(Z, t) e_z(t) + b_z U_z(t), \quad z(0) = z_0. \end{aligned} \quad (5^*)$$

The equation of dynamics of the potential of the R&D sector:

$$\begin{aligned} \frac{d}{dt}[\dot{\phi}(t)] - \delta_\phi \phi(t) = G[\phi(t)]^{\gamma_1} [\alpha_{L_1}^1(t) L_1(t)]^{\gamma_2} [\alpha_K^1(t) K(t)]^{\gamma_3} [s(t)]^{\gamma_4} + \\ + \sigma_\phi(\phi, t) e_\phi(t) + b_\phi U_\phi(t), \quad \phi(0) = \phi_0. \end{aligned} \quad (6)$$

Dynamics of the volume of skilled labor resources:

$$\frac{d}{dt}[L_1(t)] - \delta_{L_1} L_1(t) = D[\phi(t)]^{\eta_1} [\alpha_{L_1}^2(t) L_1(t)]^{\eta_2} + \sigma_{L_1}(L_1, t) e_{L_1}(t) + b_{L_1} U_{L_1}(t), \quad U_{L_1}(0) = U_{L_1 0}, \quad (7)$$

Social index equation:

$$\begin{aligned} \frac{d}{dt}[s(t)] - \delta_s s(t) = H[\phi(t)]^{\nu_1} [\varepsilon_L^1(t)L(t)]^{\nu_2} [\varepsilon_K^2(t)K(t)]^{\nu_3} [\varepsilon_z^3(t)z(t)]^{\nu_4} + \\ + \sigma_s(s, t)e_s(t) + b_s U_s(t), U_s(0) = U_0. \end{aligned} \quad (8)$$

Equation of the STP index:

$$\begin{aligned} \frac{d}{dt}[\tau(t)] + \delta_\tau \tau(t) = Q[\dot{\phi}(t) + \delta_\phi \phi(t)]^{\beta_1} [\dot{L}_1(t) + \delta_{L_1} L_1(t)]^{\beta_2} [\dot{s}(t) + \delta_s s(t)]^{\beta_3} * \\ * [\dot{z}(t) + \delta_z z(t)]^{\beta_4} + b_\tau U_\tau(t), U_\tau(0) = U_{\tau 0}. \end{aligned} \quad (9)$$

Dynamics of investment model $I(t)$:

$$I(t) = \exp(\alpha t) \cdot F[K(t), L(t), R(t)],$$

$$\begin{aligned} \frac{d}{dt}[K(t)] + \alpha K(t) = I_h(t) - C(t) - D(t) - B(t) + \\ + \sigma_K(K, t)e_K(t) + b_{jK} U_{jK}(t), K(0) = K_0, \end{aligned} \quad (10)$$

$$\frac{d}{dt}[I_h(t)] + r I_h(t) = h_0 I_0 - \sigma_{I_h}(I_h, t)e_{I_h}(t) + b_{I_h} U_{I_h}, I_h(t_0) = h_0 I(t_0) = h_0 I_0. \quad (11)$$

Consumption dynamics model:

$$dC(t) = A(t)K(t)dt - (1 - \alpha)K(t)dt + A(t)K(t)dW_C(t) \quad (12)$$

$$\text{or} \quad \frac{d}{dt}C(t) = A(t)K(t) - (1 - \alpha)K(t) + A(t)K(t)\sigma_C(C, t)e_C(t), \quad (12^*)$$

where $Y(t)$ - the volume of "useful" output, $K(t)$ - capital, $L(t)$ - number of employees, $C(t)$ - volume of consumption, $Z(t)$ - volume of pollution ("harmful" output), $I(t)$ - investment, $R(t)$ - other resources, $D(t)$ - inputs for pollution abatement and monitoring, $B(t)$ - costs of hazard and sustainable development and $e(t)$ - the realization of a random variable obeying a standard normal law with an average equal to zero and a dispersion equal to one. Other notations are given in S.K.Ramazanov and K. Osterm (Ramazanov & Sergienko, 2014; Osterm, 1970).

Random processes that are taken into account in the equations of system (1) - (12) are increments of Wiener processes distributed under a normal law with a mean zero and a dispersion proportional to the duration of a given time interval. Using the indicated property of increments of Verniers random processes and using the Euler-Marouei method, one can construct a discrete approximation of stochastic equations of system (1) - (12) in the form of linear recurrence relations.

Thus, in order to predict the development of an innovative economy on the basis of an Integral stochastic model of with control of growth dynamics can be represented as the following of relevant system of difference (discrete) equations (1p) - (12p):

$$\Phi_{t+\Delta, j}(\circ) = \Phi_{t, j}(\circ) + \alpha_j \Phi_{t, j}^+(\circ) - \beta_j \Phi_{t, j}^-(\circ) + \sigma_j(\Phi_{t, j}, t)dW_{jt} + b_j U_{jt}.$$

$$K_{t+\Delta} = K_t - (\alpha K_t - I_t + C_t + D_t + B_t)\Delta + \sigma_K \Delta \xi_t + b_K \Delta U_{K,t}, \quad t = 0, 1, \dots, \quad (1p)$$

$$Y_t = F(K_t, L_t, R_t, \xi_t) = \left[\beta_1 K_t^{\frac{\delta-1}{\delta}} + \beta_2 L_t^{\frac{\delta-1}{\delta}} + \beta_3 R_t^{\frac{\delta-1}{\delta}} \right]^{\frac{\delta}{\delta-1}} + \sigma_Y \xi_t, \quad (2p)$$

$$\text{or} \quad Y_t = A \tau_t \left[(1 - \alpha_K^1(t) - \alpha_K^2(t) - \alpha_K^3(t)) K_t \right]^{\alpha_1} \left[(1 - \alpha_{L_2}^1(t) - \alpha_{L_2}^2(t)) L_{2t} \right]^{\alpha_2} + \sigma_Y \xi_t, \quad (2^*p)$$

$$L_{t+\Delta} = L_t + (\gamma_L L_t - \gamma_Z Z_t + \gamma_C C_t)\Delta + \sigma_L \Delta \xi_t + b_L \Delta U_{L,t}, \quad t = 0, 1, 2, \dots, \quad (3p)$$

$$R_{t+\Delta} = R_t + (\gamma_R R_t + \gamma_K K_t - Y_t - \gamma_L L_t)\Delta + \sigma_R \Delta \xi_t + b_R \Delta U_{R,t}, \quad t = 0, 1, \dots, \quad (4p)$$

$$\text{or} \quad R_{t+\Delta} = R_t + (d(K_t, L_t, R_t) + \gamma_K K_t - \gamma_L L_t - Y_t)\Delta + \sigma_R \Delta \xi_t + b_R \Delta U_{R,t}, \quad t = 0, 1, \dots, \quad (4^*p)$$

$$Z_{t+\Delta} = Z_t + (g(Z_t) + f^*(C_t, K_t, L_t, R_t)(1 - \eta C_t))\Delta + \sigma_Z \Delta \xi_t + b_Z \Delta U_{Z,t}, \quad t = 0, 1, 2, \dots, \quad (5p)$$

$$z_{t+\Delta} = z_t + (\delta_z z_t + E[\phi_t])^{\nu_1} [\alpha_L^1(t) L_t]^{\nu_2} [\alpha_K^2(t) K_t]^{\nu_3} \Delta + \sigma_z \Delta \xi_t + b_z \Delta u_{z,t}, \quad t = 0, 1, 2, \dots, \quad (5^*p)$$

$$\begin{aligned} \phi_{t+\Delta} = & \phi_t + (\delta_\phi \phi_t + G[\phi_t]^{\gamma_1} [\alpha_{L_1}^1(t) L_{1t}]^{\gamma_2} [\alpha_K^1(t) K_t]^{\gamma_3} [s(t)]^{\gamma_4}) \Delta + \\ & + \sigma_\phi \Delta \xi_t + b_\phi \Delta u_{\phi,t}, \quad t = 0, 1, 2, \dots, \end{aligned} \quad (6p)$$

$$L_{1t+\Delta} = L_{1t} + (\delta_{L_1} L_{1t} + D[\phi_t]^{\eta_1} [\alpha_{L_1}^2(t) L_{1t}]^{\eta_2}) \Delta + \sigma_{L_1} \Delta \xi_t + b_{L_1} \Delta u_{L_1,t}, \quad t = 0, 1, 2, \dots, \quad (7p)$$

$$\begin{aligned} s_{t+\Delta} = & s_t + (\delta_s s_t + H[\phi_t]^{\nu_1} [\varepsilon_L^1(t) L_t]^{\nu_2} [\varepsilon_K^2(t) K_t]^{\nu_3} [\varepsilon_z^3(t) z_t]^{\nu_4}) \Delta + \\ & + \sigma_s \Delta \xi_t + b_s \Delta u_{s,t}, \quad t = 0, 1, 2, \dots, \end{aligned} \quad (8p)$$

$$\begin{aligned} \tau_{t+\Delta} = & \tau_t + \{ \delta_\tau \tau_t + Q \left[\frac{\phi_{t+\Delta} - \phi_t}{\Delta} + \delta_\phi \phi_t \right]^{\beta_1} \left[\frac{L_{1t+\Delta} - L_{1t}}{\Delta} + \delta_{L_1} L_{1t} \right]^{\beta_2} \left[\frac{s_{t+\Delta} - s_t}{\Delta} + \delta_s s_t \right]^{\beta_3} * \\ & * \left[\frac{z_{t+\Delta} - z_t}{\Delta} + \delta_z z_t \right]^{\beta_4} \} \Delta + \sigma_\tau \Delta \xi_t + b_\tau \Delta u_{\tau,t}, \quad t = 0, 1, 2, \dots, \end{aligned} \quad (9p)$$

$$K_{t+\Delta,h} = K_{t,h} - (\alpha K_{t,h} + I_{ht} - C_t - D_t - B_t)\Delta + \sigma_K \Delta \xi_t + b_{K_h} \Delta U_{K_h,t}, \quad t = 0, 1, \dots, \quad (10p)$$

$$I_{ht+\Delta} = I_{ht} - (r I_h(t) + h_0 I_0)\Delta + \sigma_{I_h} \Delta \xi_t + b_{K_h} \Delta U_{K_h,t}, \quad t = 0, 1, \dots, I_{h,0} = h_0 I(0) = h_0 I_0, \quad (11p)$$

$$C_{t+\Delta} = C_t + \{ A_t K_t - (1 + \delta) K_t \} \Delta + A_t K_t \sigma_C \Delta \xi_t + b_C \Delta U_{C,t}, \quad t = 0, 1, \dots, \quad (12p)$$

where Δ - step the time interval at which we will make calculations; ξ_t is the realization of a random variable that obeys a standard normal law with an average equal to zero and a dispersion equal to one. We also note that here $z(t)$, $s(t)$, $\tau(t)$, $\phi(t)$ are the indices of the corresponding basic indicators (Galitsin & Ramazanov, 2017).

We note that for the computer realization of stochastic difference (discrete) equations (1p) - (12p) it is necessary to pass to the average variables $x(t)=(Y(t), K(t), L(t), R(t), Z(t), z(t), s(t), \tau(t), \phi(t), I_h(t), C(t))$, that is their mathematical expectations, $\bar{U}_t$ and $\bar{u}_t$ - relevant control vectors.

Optimal control / management criteria options. Eco-economic development strategy selection criterion:

$$E\left[J(C, Y, D, B, \bar{U}_t)\right] \rightarrow \max,$$

where $J(C, Y, D, B, \bar{U}_t)$ - goal function, and E - expectation value symbol. Consequently, the hierarchical optimization model of the system is obtained in the following form:

$$\{E\{Z\} \rightarrow \min, E\{K\} \rightarrow \max, \dot{Z} = \chi(Z, K, L, R, c), \dot{K} = \phi(K, L, R, c).$$

In case of a "small" integral management model, utility function (UF) is a function of the parameters / variables $\tilde{u}(\alpha_1, \alpha_2, \alpha_3, \alpha_4)$, where $\{\alpha_k(t), k=1, \dots, 4\}$ - shares of costs for non-manufacturing, environmental costs, R&D efforts, for safety and security, innovation and information technologies, etc., and then the following relationship will be the optimality criterion:

$$\Lambda(c, k, z, L, \tau, S) = \int_{t_0}^T \tilde{u}(\alpha_1, \alpha_2, \alpha_3, \alpha_4) \exp(-\theta t) dt \rightarrow \max_{\{\alpha_i\} \in \bar{\Omega}}.$$

To resolve the EEC tasks on the basis of the presented stochastic and deterministic models, one can use the known classical methods of optimal control with restrictions. Generally, the optimization criterion can be represented as $\Lambda(\bar{a}) = \int_{t_0}^T \tilde{u}(\alpha_1, \alpha_2, \alpha_3, \alpha_4, \dots) \exp(-\theta t) dt \rightarrow \max_{\{\alpha_i\} \in \bar{\Omega}}$. Therefore, socio-ecological, innovation and

other optimality criteria are also required integrally!

Control synthesis task in stochastic systems. Let us consider the optimal management synthesis task in stochastic linear systems (Sultan Ramazanov etc, 2019).

Phase state of the system means the vector $x=(x_1, x_2, \dots, x_n)$, where $x_i, i=1, \dots, n$ - aggregate of data describing the i-th sector of the system. Let us assume that all the sectors are provided with some management levers: $u=(u_1, u_2, \dots, u_n)$.

Each of the listed parameters, in its turn, represents a vector composed of the numeric values of different characteristics of the system dynamics. Let us assume that $[t_0, t_k]$ - reviewed system development period. Let us designate as ξ the vector of some additional parameters determined by means of forecasting using statistical data of the system, or which are constants. Consequently, the dependence is studied of each variable $x_i, i=1, \dots, n$ from the managing variables u_i of the system states and the vector of parameters ξ .

The linearized system model looks as follows:

$$\dot{x}(\xi, t) = A(\xi)x(\xi, t) + B(\xi)u(\xi, t), \quad x(\xi, t) \in R^n, \quad u(\xi, t) \in R^m, \quad A(\xi) \in R^{n \times n}, \quad B(\xi) \in R^{n \times m};$$

where $A(\xi) = [A_{ij}(\xi)]$ $B(\xi) = [B_{ij}(\xi)]$ - matrices with parametric uncertainty;

$x(\xi, t) = [x_i(\xi, t)]$ - system state vector;

$u(\xi, t) = [u_i(\xi, t)]$ - management vector; ξ - vector of stochastic processes.

The task of optimal management synthesis for a stochastic dynamic system is posed as follows: to find an optimal management law in the form of (Osterm, 1970; Pshikhopov, 2009; Sultan Ramazanov et al, 2019): $u(\xi, t) = -L\hat{x}(\xi, t)$ and the objective functional for optimization (minimization) should be predetermined in the following form:

$$J = \int_{\Omega} \left\{ \int_0^{t_k} (x^T(\xi, t)\Theta x(\xi, t) + u^T(\xi, t)Ru(\xi, t)) dt \right\} \rho(\xi) d\xi.$$

For example, the optimization problem with the terminal control criterion can be represented as the problem of minimizing the quadratic functional:

$$J[u(t)] = x^T(t_f)\Phi x(t_f) + \int_0^{t_f} [x^T(t)\Omega(t)x(t) + u^T(t)R(t)u(t)] dt,$$

and the optimal control problem itself will look like: $\bar{J}[u(t)] = E\{J[u(t)]\} \Rightarrow \min$

Here the symbols "T" stands for the transpose operation, and "E" stands for the operation for determining the mathematical expectation ("averaging").

In a simple case, linear observation equation may be used in the following form: $y(t) = H(t)x(t) + \eta(t)$. In this equation, the observation $H(t)$ is represented by a stochastic observation matrix, which can be preset in practical terms, and $\eta(t)$ is the "white noise" type process, which can be preset based on statistical data. In doing so, two independent tasks are to be resolved based on the separation principle (Ramazanov, 1982; Osterm, 1970; Pshikhopov, 2009).

In the early papers of the first author of this paper, the task of optimal evaluation (filtration) under the conditions of multiplicative-additive mixtures was resolved using the integral description of the filter (Ramazanov, 1982).

However, the filtration task can also be conveniently resolved using the Kalman filter for the linear case and the Stratonovich filter for the non-linear right part of the dynamic's equation. State estimates are found as the conventional average values with the building and solution of the non-linear dispersion equations of the Riccati type. The filter gives a solution for the stochastic differential equation. It can be implemented in the form of the known closed loop system for the distribution density of the initial conditions. The obtained state estimate $\hat{x}(t)$ is used in resolving the other task - optimal management of the type $\hat{u}(t) = -L(t)\hat{x}(t)$.

As mentioned above, the optimal management task is usually set on the basis of the Bellman principle or the maximum principle.

CONCLUSIONS

Based on the use of modern methods, models, information and innovative technologies for prediction of the state of nonlinear dynamics of ecological - economic and social - humanitarian systems, integrated stochastic models of objects and processes suitable for systems of systemic crises have been developed and investigated. The paper considers the integration of many spheres and sectors of activity of modern complex systems such as SEEHS, which function and develop in difficult conditions of instability and crises. As a result of complex formalization, one of the variants of an integrated social, ecological, economic and innovation nonlinear model of dynamics in the form of a system of differential and functional stochastic equations is obtained. To predict the development of the state of the innovation economy, an integrated stochastic nonlinear model of growth dynamics developed and investigated is developed and investigated, which is suitable for the minds of risks and crises. The aspects of integration of many spheres and sectors of activity of modern complex systems, which function and develop in the current conditions of instability, are considered in this paper. The prospect of further research is the presentation of the proposed integral model in the phase space with observation equations, the development of filters and optimal control algorithms.

The paper deals with the problem of sustainable development and innovative integral modeling approach in the management of technogenic objects and processes as a system of socio-eco-economic and humanitarian type. Based on the use of information and innovation technologies in order to forecast the non-linear dynamics of eco-economic and socio-humanitarian systems, integrated stochastic models of objects and processes were developed and studied, suitable for the conditions of systemic crises.

Conflict of interests

The authors declare no conflict of interest.

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SCIENTIFIC ENQUIRY INTO THE FLAT SOCIAL MEDIA INNOVATION BASED MODELLING OF FLAT SOCIAL ENTREPRENEURSHIP FOR ECONOMIC AND NON-ECONOMIC OPPORTUNITIES

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ABSTRACT

Flat Social Entrepreneurship is an innovation of modelling in the field of social entrepreneurship evolved as the innovation of technology and flat social Medias used in daily life of an individual or an organization. Innovation and technological resources are key to solve social problems that are dealt to have economic and non-economic opportunity as per the need of the individuals and business society. It is a new school of thought in business and management sector. As like as flatly appeared, modelling of flat social entrepreneurship has been developed. The main aim of this investigation is to begin debate flat social entrepreneurship and innovation practices in the world. This paper is based on scientific review in context of social entrepreneurship, flat social Media and innovation and propounded modelling of flat social entrepreneurship. It is a grounded theory based on the first layer from the bottom of flat earth theory as a fundamental, second layer is use of flat social Medias prone entrepreneurship that is a kind of flat social entrepreneurship in the third layer, which could be a basement of innovation. On the fourth layer at top, innovation create new economic and non-economic opportunities. It has a broad scope since flat social Media use in the startup directly and indirectly. Ultimately, innovation cycle takes socio economic transformation by flat social entrepreneurship in the planet.

Keywords: Flat Social entrepreneurship, modelling, innovation and economic opportunities

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INTRODUCTION

Social entrepreneurship modelling has been widening day by day. Recently, it is regarded as modelling of economic opportunities at the low cost of supply chain in the world. By the discovery and innovation of communication technology, the modelling has become a flat social entrepreneurship. Mass of the practitioners of social entrepreneurship have been carrying its approach to create economic benefits directly and indirectly. Its application has enlarged by information and communication technology innovation. The value generation is crafted by modern means of flat social media by which flat social entrepreneurship has existed in the world for the innovation of economic opportunities at all in the business community. This era has become a

communication technology-based innovation like flat social communication network for social change giving the birth of flat social entrepreneurship to determine economic welfare. Flat social entrepreneurship modelling has been shaping the range of its practicalities as the means of flat social Media evolved. The focal point of this scientific enquiry is to explore modelling of flat social entrepreneurship for economic opportunities generated by flat social Media applications.

Flat Social entrepreneurship has been flourished. Modern information and communication technology governing the innovation. The high effect of means of flat social Media has been observed as a contribution into flat social entrepreneurship. Each and every means of communication and information technology could be the best part of change in the way of innovation. The human culture of idea exchange through flat social Media and benefiting has a significant role to the flat social entrepreneurship as catalyst modelling.

As the previous literature assessment and the qualitative evidence from this scientific inquiry, it is found that it is an innovation of flat social entrepreneurship by the cause of excessive use of flat social Media based transformational knowledges for the economic opportunities and its periphery. Besides, generation to generation; the version of flat social Media has been changed the life system of flat social entrepreneurship lead innovation.

Flat social entrepreneurship is part of business communities. It has broad prospects to find economic opportunities directly and indirectly. Thereby technology and innovation has been made flat social entrepreneurship more sustainable and stronger having application of flat social Media.

Discovery of communication technology has been best practicalities for the social change and economic earnings and welfare. Level of development of society may be assorted in different countries. Flat social entrepreneurship has been emerged through research, development and use of flat social Media, which has led economic growth and development. Means of communication in social innovation profiles have gauged flat social entrepreneurship in business community. Flat social entrepreneurship is more practical in business community's economic and non-economic opportunities. Hence, the main aim of the article is to find out how flat social entrepreneurship innovative modeling has created economic and non-economic opportunities by the production function of flat social Media.

The methods of research

Descriptive and analytical research design is followed in the study. The major concern is to review of innovation of modelling of flat social entrepreneurship based on flat social Media line that has fulfilling profitable and non-profitable opportunities of human and planet to have a key successor.

Results

Flat social entrepreneurship is an approach of social enterprise, which is based on flat social Media. The main concept of this modelling is the result of use of flat social Media that creates an economic and non-economic opportunity to worldwide business communities. Adoption flat social Media in business and society is the

planet of flat social entrepreneurship. In addition, the scope of flat social entrepreneurship could be a part of e-commerce, e-business, service business, real business brand and social enterprise for the economic and non-economic activities as well as social problem. Any time flat social Media has been used in the world passing the information for the flat social enterprise. Social entrepreneurship is a means to improve societal problems and catalyze social change (Alvord et al., 2004).

Full connectivity of flat social Media has been accelerated social business life treating the social problems, which has been establishing the new phenomena of flat social entrepreneurship. The innovative flat social entrepreneurship uplifting the value of social mobility towards the inclusive growth of all persons as of globalization perspective. The whole world exposure and experiences booming by flat social entrepreneurship outsourcing by flat social Media. Parallel use of flat social Media in each and every corner boosting flat social entrepreneurship. Flat social Medias are working globally and establishing flat social entrepreneurship individually in value creativity based on resource available in the surroundings and receiving from the flat social Medias. Unlike, flat social Medias are used country wise and specified its application as per the nature of work. Social entrepreneurship getting input from flat social Media icon. It is a like a device Social entrepreneurship has become an immense tent, which includes all kinds of socially beneficial activities (Martin & Osberg, 2007). Flat social Media use is enough for non-economic benefits. The emergence of the social enterprise is often attributed to shifting stakeholder expectations of not-for-profit organizations to achieve larger-scale social impact while also diversifying their funding (Reis, 1999). The individual level of analysis of social entrepreneurship has often been defined in terms of established models of the commercial, private-sector entrepreneur (Brockhaus, 1980). Social entrepreneurship ventures often look to hybrid commercial models that blend economic and social value creation, often known as social enterprises (Alter, 2002). Social entrepreneurship has largely been focused on defining what it is and what it does and does not have in common with commercial entrepreneurial activity (Dees, 1998).

Entrepreneurs are the creators of civilization. The study of their life and work is of the highest interest for a deeper understanding of the process of innovation (Sandal, 2019). Social entrepreneurs demonstrate creative network building as an important strategic tool in a far broader range of contexts than conventional entrepreneurs (Bar Nir & Smith, 2002). Marketers can no longer rely on mass media channels alone to communicate with their consumers. They must adopt new strategies if they wish to succeed (Kotler & Armstrong, 2011). The use of social media as a marketing tool allows companies to mingle with fellow professionals in the field, conduct research, connect with the community and get business opportunities (Smith & Taylor, 2004). Internet businesses to have access to international markets thereby increasing their market share. Companies can also achieve greater economies of scale (Goel, 2008). Entrepreneurs find it hard to choose appropriate types of social media from several options that are creating fragmented media choice for business utilization (Jones, et al., 2015). Social media can deliver an excellent return for entrepreneurs and can help them to capitalize on social investments (Helal et al., 2018). Social media sites are also useful for providing buyer support and hosting customer reviews and feedback (Cheng & Shiu, 2018). The practice of

internal social media stands by prominent companies communicating with international networks (Jagongo & Kinyua, 2013). There are numerous motives for the uptake of social media usage amongst companies (Uyar & Boyar, 2015). As a consequence of rapid increases in the number of social media formats, many corporations including governmental organizations continue to adopt social media platforms as an essential communications tool to interact and collaborate with others to share content. At the same time, integrated marketing activities are becoming cost effective when social media marketing is adopted (Kim & Ko, 2012). The intensification of social media has changed the way interactions take place with customers (Garcia-Morales et al., 2018). The cooperative action of entrepreneurial organizations and their partners through two-way communication on social media platforms has proven productive (Gavurova et al., 2018). To obtain required funding, influence customers' perception, spread business activity and distinguishable business models, social enterprises need to promote themselves (Dunkwu et al., 2016). Social media facilitates an innovative way to share knowledge (Koch, et al., 2013). Social media are limited to developed countries (Durkin et al., 2013). Groundbreaking and profitable ways of addressing social problems have emerged; there has been a greater focus on how ideas like social entrepreneurship can address critical social problems (Dees & Anderson, 2003). Most businesses have embraced social media, or are in process of doing so; the whole idea of reaching out to their consumers via online social networks is relatively new to the business, and in fact to the marketing world as a whole thus posing various challenges (Kasavana et al., 2010). Moreover, although much discussion has taken place regarding the benefits of social media for business progression, the reliability of such modes of communication has not yet been proven (Maree, 2017). Hence, the social Medias positive aspect and lacking of potential use has flat landscape as the planet has a flat site. The flat social media icon-based information has the parallel effect in cross borders knowledge and idea exchange. Social medialink is working at all in the business opportunities directly and indirectly.

Flat social Medias are connecting every initiator to keep up their business and social welfare. In a certain level, flat social entrepreneurship is the outcome of global integration, regional integration and local integration at the practicum of flat social Media. Technically, flat social Medias are standing as per the applications feature. Ideas are incorporated. Information flow is moved to the worldwide. As per the level of education and awareness, everyone is enjoying flat social entrepreneurship at the global scale. Remote connection and relation are in flat manner. No economic barriers. No geographical barriers. No barriers of see locked. No barriers of landlocked. It is open flow. It is parallel. It is flat transmission. Delivery approach of flat social media is social cum business. Equally benefited at all. All member of ventures and people get chance of transformation receiving information. Mobile set and computers are the part of flat social entrepreneurship where flat social Media's programs accounts are applied. Everyone generates the individual, social, business related information and exposed to the live, display, post andlike, comments, share by which business community gain momentum.

Based on reviewing all the literatures, there is dearth of such kind of study in the previous time. In overall, it is a new model in the field of social entrepreneurship. Hence, flat social entrepreneurship is by product of

modernization applying technology and accounts of flat social media flow. It is a flow of power of flat social Media's uses the flow of information concerned at parallel level worldwide. All kinds of innovative information based on flat social Medias are beneficial for the human behavior and the planet. The contribution of flat social Media is growing flatly. Therefore; based on applications of real-world exposure of flat social entrepreneurship has been a modelling in social innovation of business society.

Discussion

This study has focused on the recent evolve of new model of social entrepreneurship in the world. It has given a new dimension because of the use of flat social Medias. The core concept organically emerged the support of flat earth theory. This theory generally tells that the earth is a kind of flat substance or like disk. Here, flat social Media's functions by the disk in the disk very flatly. The dynamics in the flat earth has flat social Medias and make the economic world more productive and rest has stock of resources not in use. Hence, the backbone of flat social entrepreneurship is flat earth theory and flat social media is heart. Some times because of resource mismanagement all opportunities becoming flat economies in the world. Since, the main debate and discussion in this research is the structure of flat social entrepreneurship governing by flat social Medias in flat landscape of globe. Earth is in flat. Geography appears to see the world flat an original. The following figure reveals the innovative outcome by interacting ideas in flat social media in flat planet by this process of new modeling of flat social entrepreneurship have been nurtured innovatively.

Fig. 1. Evolve of flat Social Entrepreneurship

Source: Author's own invention, 2020.

Innovation allows experiences of economic and non-economic opportunities while social business carrying the level that accounts by flat social entrepreneurship. This is fact that all happens in flat earth. It has been proved and can be claimed that the contribution of the study augmented to flat earth is grounded in high tech world to determine flat social entrepreneurship. Whole universe has a flat segment vertically and horizontally to have benefit. People's creativity is flat. Availability of resource is flat. Management in the business is flat. Opportunities are flat; if there is less opportunity the flat economies emerged. Geography appears to see the world flat an original. Whole universe has a flat segment vertically and horizontal to have benefit. In the analysis, social media sector has been effective in flat means use all around the world. It is a vast and deep scope of as we look into the business. All persons can have flat social Media in house or in an organization or in his own business he or she pass the thought, belief, faith, hobby, or trust, sending ways of solving problems and issues.

CONCLUSIONS

Studying social entrepreneurship, the field has created the way of innovation and innovativeness in flat social Media dimension having the genetic characteristic of flat social entrepreneurship. Flatly social Medias provide services to the business society and innovation measures are carried out to deal social problems valuing business directly and indirectly. Flat social Medias have greater impact on social sector and business enterprise. Business thoughts are upgraded in the companies. General people and factories high skill labor and low skill getting information and materializing to harness their skill and business. Research output, education and experiences, share idea and information circulation, experiment, training and policy, strategy, thoughts, advocacy, convey flow, planning and visioning have been integrated in the flat social entrepreneurship model with great motivation. Thus, it seems that there is no gravity to inflow and outflow information, which reveals that the WEB is flatly connecting the people. Flat social entrepreneurship has been appeared a new model keeping growth and development dynamics flatly in worldwide. It is finally a capital.

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Conflict of interests

The author declares no conflict of interest.

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Summary

Flat social entrepreneurship modelling has been shaping the range of its practicalities as the means of flat social media evolved. The focal point of this scientific enquiry is to explore modelling of flat social entrepreneurship for economic and non-economic opportunities generated by flat social media applications. By the review, modern information and communication technology are governing the innovation and vice versa. The high effect of means of flat social media has been observed as a contribution into flat social entrepreneurship. The whole world exposure and experiences booming by flat social entrepreneurship outsourcing by flat social media. Parallel use of flat social media in each and every corner boosting flat social entrepreneurship. Flat social Medias are working globally and establishing flat social entrepreneurship individually in value creativity based on resource available in the surroundings and receiving from the flat social Medias. Any time flat social Media has been used in the world passing the information for the flat social enterprise. Technically, flat social Medias are standing as per the applications feature. Ideas are incorporated. Information flow is moved to the worldwide. As per the level of education and awareness, everyone is enjoying flat social entrepreneurship at the global scale. Remote connection and relation are in flat manner. No economic barriers. No geographical barriers. No barriers of sea locked. No barriers of landlocked. It is open flow. It is parallel. It is flat transmission. Delivery approach of flat social Media is social cum business. Equally benefited at all. All members of ventures and people get chance of transformation receiving information. Flatly, social Medias provide services to the business society and innovation measures are carried out to deal social problems valuing business directly and indirectly. Flat social Medias have greater impact on social sector and business enterprise. Business thoughts are upgraded in the companies.

INNOVATIONS AS THE MAIN CHALLENGE IN THE FIELD OF HEALTH TOURISM IN LATVIA

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ABSTRACT:

Globalization is the process which takes places in the modern world, fierce competition in the tourism market, growing demand for tourists, changing tourist preferences, development of information technologies – need point for the tourism industry, including health tourism sector, move to an innovative development path. Recognition at the state level of health sphere tourism as one of the priority areas of the national economy in Latvia opens up great opportunities for the development of innovative activities in this area. This article discusses the main directions of state policy in the field of tourism, factors affecting the innovative development of the health tourism sector in Latvia, including the role in health tourism cluster.

Key words: innovation, tourism, health tourism, SPA & Wellness tourism, cluster, resort.

JEL classification: O30; O38; O40

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INTRODUCTION

One of the main problems in Latvian tourism industry is lack of competitiveness tourism products offered, poor popularity in the world as a resort and recreation place, and underdeveloped tourism infrastructure outside Riga. All this inevitably leads needs for the industry to transition to the path of innovative development, including product, technological, marketing, organizational innovations. Such transition is possible only if state, entrepreneurs and the scientific sector are involved in the process of innovative development.

MATERIALS AND METHODS

Scientific knowledge is based on the constant search for appropriate methodological approaches and research methods. For thorough study problems of the innovative development of health tourism in Latvia, methodological issues of paramount importance.

Authors applied for systematic approach, including analysis and synthesis of the management object, in this case, sphere of health tourism, as well as a managerial decision made at state level. The importance of

systematic approach of tourism research is currently growing due to fact that processes of globalization and integration of political, economic, cultural and information space have caused changes in the tourist space. Globalization has affected the tourism world, which is becoming more and more united, countries that makes it up are increasingly interconnected and interdependent. In order to get an idea of the state of tourism in a particular country and evaluate this state, it is imperative to take into account the state of tourism in other countries and whole world.

Authors applied for method of "statistical observation" in the form of systematic collection of information on dynamics of tourism on a global scale and the scale of Latvia, the dynamics of the proportion of innovative enterprises in Latvia. The sources of information in this study were:

- reports, monitoring results of tourism industry, as well as innovative activity of enterprises, in particular, UNWTO World Tourism Barometry, OECD Economic Surveys: Latvia, Global Innovation Index 2018 rankings, European Innovation Scoreboard (EIS), etc.
- reporting by Central Statistical Office of Latvia on tourism sector of the economy and innovative activity of Latvian enterprises.

Authors analyzed documents that regulate direction and development of innovation policy of Latvia, as well as the main regulatory acts regulating tourism sector of Latvia, including health.

RESULTS AND DISCUSSION

Nowadays, tourism (Travel & Tourism) is one of the largest and dynamically developing sectors of the global economy, it creates jobs, promotes export.

In 2019, 1.5 billion international tourist arrivals were registered in the world, which is 4% more compared to the previous year. Tourist flows around the world show steady growth for the tenth consecutive year. However, it is necessary to note a slowdown in growth compared to 2017 (+ 7%) and 2018 (+ 6%). Tourism growth in 2019 was negatively impacted by uncertainties around Brexit, the collapse of Thomas Cook and several low-cost airlines in Europe., Geopolitical and social tensions and a slowdown in the global economy.

Figure 1. International tourist arrivals dynamic, % (UNWTO (2020))

* Provisional data

The fastest growing region for international tourist arrivals in 2019 was Middle East (+ 8%, which is almost twice as much compared to last year). In turn, growth in Asia-Pacific region slowed down, although it remained above average and the number of international arrivals increased by 5%. In Europe, growth was slower than in previous years (+ 4%), while it continues to lead in the number of international arrivals, having received 743 million international tourists in 2019 (51% of the world market). America (+ 2%) showed an ambiguous picture as many island destinations in the Caribbean strengthened their recovery from the 2017 hurricanes, while arrivals in South America declined in part due to ongoing social and political turmoil. Limited data for Africa (+ 4%) indicate continued high results in North Africa (+ 9%), while in sub-Saharan Africa, growth rates slowed in 2019 (+ 1.5%). UNWTO predicts an increase in the number of foreign tourists in the world in 2020 by 3-4%.

Same time, as organization notes, approximately same growth in tourist flow as in 2019 is forecasted for 2020 (from 3% to 4%), which suggests that tourism has become one of the fastest growing and most stable sectors of the world economy. Major sporting events, including the Tokyo Olympics, and cultural events such as EXPO 2020 in Dubai are expected to have a positive impact on the sector.

In 2019, 2.85 million foreign and local guests were served in tourist residences (hotels and guest houses) in Latvia, which is 1.6% more than in 2018. Compared to 2018, the number of nights spent by guests increased by 2.6% and reached 5.51 million. The average length of tourists stay in accommodation was 1.9 nights.

In 2019, 1.95 million foreign guests were served, which is 1.1% more compared to the previous year. In turn, the number of nights spent by foreign guests increased by 2.9%, reaching 3.85 million nights. Most of the guests were received from Russia (279.4 thousand), Germany (243.0 thousand), Lithuania (209.5 thousand), Estonia (171.1 thousand), Finland (110.8 thousand) and the United Kingdom (108.0 thousand)

Table 1. Number of guests served in Latvian hotels and other tourist accommodation

	2017	2018	2019
Total	2 577 338	2 808 808	2 853 333
Foreign Tourists	1 778 973	1 925 397	1 945 919
Local Latvian Tourists	798365	883 411	907 414

Source: Own calculations (info: Centrālā statistikas pārvalde, 2020)

Statistics shows slowdown in tourist flow. It has been noted that foreign tourists rarely choose Latvia as their travel destination, mainly they visit the three Baltic states (Lithuania, Latvia and Estonia). This circumstance is reflected, in particular, in the small number of nights spent by foreign tourists in Latvia. In these conditions, it is necessary to strengthen the marketing of Latvian tourism, clearly define the target audience, which will allow hotels and tour operators to understand in which direction to move.

In 2016, direct contribution of the tourism industry in Latvia to the country's GDP amounted to about 1 billion euros, or 4.1%. Direct tourism exports amounted to 783 million euros, representing 4.5% of total exports. Tourism itself provides 36 thousand jobs, together with related industries the tourism industry in Latvia provides almost 79 thousand jobs, or 8.9% of total employment (OECD, 2018).

Tourism is characterized by high "multiplier" effect. According to World Tourism Organization, tourism has an indirect effect on development of more than 32 industries. So, the tourism industry uses the services of airports, banks, insurance organizations, etc., investing its share of money in their development. Accordingly, more of these funds will be spent domestically and will go to development, higher effect of the "multiplier" and vice versa. By influencing such sectors of economy as production of consumer goods, transport and communications, construction, medicine, agriculture, tourism, it accelerates the socio-economic development of state.

Currently, global tourism industry is undergoing significant changes: tourist preferences are changing, there is a constant increase e-commerce, increasing the diversity and number of tourism products, there are new tourism goals. In this regard, conditions of further globalization and increased competition, Latvia needs to use competitive advantages in order to develop tourism products and territories with a high potential for long-term development. The goal of Latvian state tourism policy is sustainable development of tourism by increasing the competitiveness of tourism products in foreign markets. "The main guidelines for the development of Latvian tourism for period 2014–2020" as one of the main areas of activity include promoting the development of competitive tourism products by supporting development of new, innovative, high-value tourism products, tourism infrastructure development a) promoting the formation of regional tourism clusters and the inclusion of the Latvian tourism product in the general tourism offer of the countries of the Baltic Sea region (Ekonomikas ministrija, 2014).

The following definition of innovation has been adopted in Latvia: "Innovation is a process during which new ideas, developments and technologies in scientific, technical, social, cultural or other fields are embodied in marketable and competitive products and services."

Figure 2. Dynamics of innovative share enterprises in Latvia, % of total number of enterprises

Source: Latvijas statistikas gadagrāmata, 2018

In 2014-2016, innovatively active enterprises in Latvia accounted for 30.3% of total number of enterprises, innovatively active enterprises in service sector accounted for 28.5% of the total number of enterprises in this field.

According to Global Innovation Index 2018 rating, Latvia is 34th in the Global Innovation Index, Estonia is 24th, Lithuania is 40th. In Latvia, overall growth of innovative activity of enterprises is mainly associated with technological innovation, while innovation activity in the field of marketing and organizational innovation is much lower.

The main documents regulating the direction and development of innovation policy in Latvia are: The main directions of national industrial policy for 2014-2020 (Nacionālās industriālās politikas pamatnostādnes 2014. – 2020. Gadam), the Strategy for smart specialization (Viedās specializācijas stratēģija), Latvian national development for 2014-2020 (Latvijas Nacionālais attīstības plāns 2014. – 2020.gadam), Long-term development strategy of Latvia until 2030 (Latvijas ilgtspējīgas attīstības stratēģija līdz 2030. gadam), Main directions for the development of science, technology and innovation for 2014-2020 (Zinātnes, tehnoloģijas attīstības un inovācijas pamatnostādnes 2014.-2020. Gadam). The basic document is European Union Development Strategy until 2020 - Europe 2020, developed in 2010 by the European Commission - Europe 2020. One of the three basic development priorities in the Strategy indicates reasonable growth - the transition to an economy based on knowledge and innovations (Europe 2020, 2010).

In relation of tourism, term “innovation” in Latvia is interpreted as follows: “Compared to existing offer on the market, new service is offered, new kind of existing service, an efficient technological process, production method, new or improved way of providing a product, etc., which helps company maintain and strengthen its position in the market, ensures competitiveness, prolongs the tourist season, increases turnover and creates other advantages” (Ekonomikas ministrija, 2014).

Despite the differences in the interpretation of the types of innovations, it can be recognized that tourism enterprises that embarked on an innovative path of development are guided by the following areas of innovation:

- creation of new service or new variety of an existing service,
- introduction of effective technological process,
- search for a new or improved way of providing a tourism product,
- use of new tourism resources not previously used,
- search and development of a new market (new markets) sales,
- implementation of organizational changes.

Innovation activities should be aimed at solving the tasks formulated in the Latvian tourism policy planning documents: increasing the number of multi-day travelers, reducing the seasonality effect, increasing the occupancy rate of accommodation facilities for tourists from off-season, ensuring the growth of the tourism product profitability, as well as the annual increase in the country's tourism product export.

According to European Innovation Scoreboard (EIS) for 2019, Latvia remains in Moderate Innovators group, however, it should be noted that in general innovation index has increased. At the same time, venture capital spending increased significantly. It should be noted the positive trends in the innovative activity of small and medium enterprises in Latvia, which include the majority of tourism industry enterprises. The innovative scoreboard shows that since 2011 there has been significant increase in marketing or organizational innovations in small and medium enterprises and the total number of innovators. At the same time, number of indicators worsened, for example, R&D expenses in the business sector, as well as innovative expenses not related to R&D.

Table 2. Changes in Latvian innovation sector between 2011 and 2018

Indicator	2011 y.	2018 y.
Summary innovation index	48,0	60,3
R&D expenditure in the public sector	36,5	37,4
Venture capital expenditures	15,0	148,2
Firm investments	69,0	46,4
R&D expenditure in the business sector	17,6	8,6
Non-R&D innovation expenditures	149,4	90,4
Innovators	24,7	39,7
SMEs product/process innovations	34,4	41,0
SMEs product/process innovations	11,6	43,4
Intellectual assets	65,1	53,5

Source: European Innovation Scoreboard, 2019

The main challenges to competitive and sustainable development tourism in Latvia are:

- Reduced average tourist spending per day. Although the number of tourists is growing and exceeded forecasts by 8%, their total expenses did not reach the expected level due to decrease in average expenses per tourist per day.
- Strong seasonality of tourism, leading to fluctuations in business activity. The average occupancy rate of hotel rooms in low season drops to 30%, and in the high season it can reach 60-80%.
- Low competitiveness of Latvia as a tourist destination in the region, EU and around the world. Latvia is relatively unknown as a tourist destination, and it is important to increase the recognition of this tourism market.

An assessment of the current situation and challenges in the tourism sector shows that one of the significant problems is limited resources and the inability to offer tourism product that meets the requirements of the modern market, as well as to ensure its thoughtful promotion on the market. In these conditions, the state tourism policy is aimed at:

- promoting investment in the development of existing tourist facilities and offers, taking into account the internal potential of the territory of Latvia and the existing indicators of tourism development

- assistance in the creation of new tourist facilities in areas where there are prerequisites for the further development of tourism, for example, fame, availability of tourist flow, additional services (accommodation facilities for tourists, meals, wellness services, resort infrastructure and natural healing resources).

“Basic Guidelines for the Development of Latvian Tourism Period 2014–2020” as strategic types of Latvian tourism define:

1. Tourism MICE (deals and events).
2. Health tourism.
3. Natural tourism.
4. Cultural tourism.

Successful development of these types of tourism is impossible without an innovative component. So, health tourism today is developing in direction from the natural resource to investment and innovation stage of development, in which the available natural resources lose their leading role in the formation of competitive advantages in the tourism market.

Table 3. Health tourism categories in Latvia

Category	Example
SPA&Wellness tourism	SPA-programs, detox-programs, cosmetology services
Rehabilitation / spa treatment	Physiotherapy, medical rehabilitation, spa treatment programs, including spa healing resources
Export of medical services	Diagnostics, dentistry, bariatrics, ophthalmology, oncology, orthopedics, plastic surgery, dermatology, etc.
Ethnoscience	Country baths, herbal teas, gifts of nature

Source: Latvijas Investīciju un attīstības aģentūra, 2018

Clusters play an important role in the innovative development of tourism industry today.

One of the first authors to define cluster was suggested by Michael Porter: “Clusters are a group of geographically neighboring interconnected companies (suppliers, manufacturers, etc.) and related organizations (educational institutions, government bodies, infrastructure companies) operating in a certain field and complementary each other” (Porter, M., 2000). The definition of M. Porter is consonant with the definition of a cluster by the European Commission: “Clusters are a set of enterprises and related supporting institutions that closely cooperate in a specific area (region)” (European Commission, 2020).

In 2012, Latvian Health Tourism Cluster found, purpose to offer quality medical services to foreign patients and local residents. Initially, it consisted from 22 participants, and in 2016 already 60 participants – merchants of wide range of health tourism services: resort rehabilitation centers, public and private hospitals and clinics, surgical centers, dental and eye clinics, SPA hotels and SPA centers, eco-cosmetics

manufacturers, travel agencies, research and educational institutions, local governments in a number of cities (Jurmala, Carnikava, Saulkrasti, Sigulda, etc.), non-governmental organizations.

Participation in this cluster makes it possible to improve cooperation between those working in health tourism sector, carry out joint marketing activities, create and offer the market an integrated, innovative tourism product, while making it more accessible to both local and foreign tourists. The main activities of this cluster are:

- Joint marketing activities,
- Workshops, meetings and exhibitions abroad,
- Cooperation of enterprises in creating a comprehensive offer in the field of health tourism,
- Creation of new and innovative products that use Latvian therapeutic agents (cluster + research institutions),
- Cooperation between cluster partners and higher education institutions,
- Providing regulatory framework for health tourism (medical visas, obtaining resort status, etc.) (The Latvian Health Tourism Cluster).

In 2013, a memorandum of cooperation was signed between Lithuanian medical tourism cluster, Latvian health tourism cluster and Estonian health tourism cluster, which resulted in creation of the Baltic Medical Tourism Cluster. This cluster was created to solve a number of common problems - increasing competitiveness of the Baltic region in the field of health tourism services, developing common standards for the quality of services provided, pooling the resources of three countries for joint promotion to foreign markets.

The problems on path to successful development of the cluster of health tourism services in Latvia include statistics and accounting, the unformed image of Latvia as an exporting country of health tourism services, an uneven level of quality of services provided, insufficient resources for marketing activities abroad, etc. As one of the priorities identified need to separate medicine and Wellness. SPA & Wellness tourism is relatively new but rapidly developing direction of health tourism, in which the innovative component is most pronounced. Most hospitality industry experts point to steady increase in the number of modern tourists, whose needs as an indispensable component during the trip include getting wellness and SPA procedures. However, today in the legal acts, among specialists and at the household level, there is a certain confusion in definitions of health, medical and SPA & Wellness tourism. Thus, Latvian Tourism Law defines the term "health tourism" as a type of tourism, the purpose of which is to improve the general condition and well-being of the body, prevention, treatment and rehabilitation, using also natural healing resources" (LR Saeima, 1999). In addition to this definition, the Tourism Law provides the definition of "recreational tourism", which is defined as a type of tourism, the purpose of which is to restore the physical and mental potential of person, with the rational use of natural and artificial resources of recreation and recreation. In this regard, it should be noted that the use of term "recreational tourism" from methodological

point of view is inaccurate, since tourism itself is part of recreation, because in any type of tourism there is a recreational component.

At the same time, Law on Tourism does not contain the definitions of “medical tourism”, “SPA tourism” and “Wellness tourism”. This situation indicates that legal regulation in the field of tourism lags behind the realities of development of this sector of the national economy. It seems necessary to supplement the Latvian Tourism Law with the categories of “medical tourism”, “SPA tourism” and “Wellness tourism” in the following formulations:

- Medical tourism - tourist trips carried out by both residents and non-residents in order to receive medical services, undergo rehabilitation, perform medical procedures, operations or preventive health recovery;
- SPA tourism - tourist trips carried out by both residents and non-residents, the main purpose of which is health improvement, relaxation and cosmetic body care by obtaining mainly water and other SPA procedures in tourist SPA destinations
- Wellness tourism - tourist trips carried out by both residents and non-residents with the aim of improving and balancing all the main components of human life, including physical, mental, emotional, professional, intellectual and spiritual, through participation in preventive, active, life-promoting events, such as fitness, healthy eating, relaxation, pampering and healing treatments.

Terminological certainty helps to classify certain types of wellness services and determine direction of innovation in the relevant field.

An important contribution to development of health tourism is made by small and medium-sized businesses, which have limited financial opportunities for innovation and marketing, but at the same time are very flexible in responding to changing market conditions and targeting specific target segments of Latvian Action Plan “Growth and Employment” for the period 2014- 2020, funded by the EU structural funds and the Cohesion Fund, under the priority direction “Competitiveness of Small and Medium-Sized Businesses” provides support for new businessmen, growth of existing businessmen, promotion of access to financing for businessmen, provision of services to business incubators (consultations, mentoring, seminars). This program is also aimed at assisting in the development of foreign markets and strengthening Latvia's international competitiveness in the field of MICE1 and health tourism, and at developing clusters. Under this program, 4418.2 million EUR are available (LR Ministru kabinets, 2015).

An important task for the innovative development of health tourism is provision of enterprises with qualified personnel meeting market requirements. In particular, this issue is extremely relevant for Latvian companies operating in the field of SPA & Wellness tourism, experiencing a shortage of specialists in this service sector. In 2010, SPA-master profession was included in Latvian standard of professions, later on the recommendation of experts renamed to “SPA-specialist”.

Today, number of professional school's train SPA-specialists and SPA-administrators, however, the actual problem for Latvia at this moment is the provision of enterprises with SPA-managers.

There is no “Wellness Specialist” profession in Occupational Standard, which is an obstacle to the development of appropriate curricula in educational institutions at various levels. The main directions of the development of education for the period 2014-2020 are aimed at solving this problem, providing for the facilitation of cooperation between educational institutions and employers, the development of professional educational programs and standards of professions that meet the needs of the industry.

The unresolved problem remains the standardization of SPA and Wellness services. At one time, representatives of Latvian SPA-school, with the assistance of experts, developed the standard "SPA operators and services", which includes a classification and certification system for SPA. But, at this moment, this system is not implemented everywhere.

Also, standard has not been developed that sets out the basic provisions and regulatory requirements for Wellness facilities and Wellness operators. Meanwhile, the standardization of these services is aimed at solving a number of problems, among which - promoting the development of innovative activities in SPA and Wellness industry, including its tourism sector.

Successful development of SPA and Wellness tourism sector is impossible without a constant search for product innovations. So, Latvian resort city of Jurmala has a long tradition of a medical resort. In late 1980s, 24 sanatoriums, 34 boarding houses and rest houses, three campsites, two hotels worked in Jurmala. Today in Jurmala, offer of SPA and Wellness services is more developed, although in recent years, rehabilitation and medical services have begun to develop and popularize more actively.

Six institutions provide rehabilitation and spa treatment services in Jurmala:

- Resort rehabilitation center “Jaunkemeri”,
- National rehabilitation center “Vaivari”,
- Rehabilitation center "SIVA",
- Sanatorium "Belarus",
- Sanatorium "Amber Coast",
- Clinic "Dzintari".

In turn, SPA and Wellness services in Jurmala provided by 10 SPA centers, 16 cosmetology centers, 12 pools, 21 bath complexes operating in hotels, resorts, Livu water park. The range of services offered by SPA and Wellness is dominated by Russian and Oriental traditional products (Russian bath, Thai massage, etc.), however, no emphasis is placed on products typical for Latvia (traditions of the Latvian bath, procedures using Latvian healing herbs, honey, etc.) This situation gives a certain direction to the development of product innovations in the field of health tourism.

One of the most important areas for the development of the health tourism sector in Latvia is the revival of the resort industry. In this direction, Latvian Association of Resort Towns operates, purpose of which is to promote the development and adoption of regulations governing the activities of resorts, the development and expansion of the resort towns of Latvia. One of the main tasks of the Association is to obtain state support in developing the infrastructure of resort cities, which helps to attract tourists and vacationers, as

well as expanding the circle of Latvian territories that have received resort status. The members of the Latvian Association of Resort Cities are currently nine municipalities and 50 entrepreneurs. The revival and development of the Latvian resort industry will undoubtedly contribute to the growth of innovative activity in this area.

A condition for innovative development is introduction of technological innovations, involving the use of new equipment and technologies in the development, promotion and provision of tourism services, including the introduction of modern information technologies, without which it is impossible to imagine the activities of the modern tourism industry. Innovative enterprises of rapid growth such as start-up can also play an important role in this process (Pukała & Petrova, 2019).

Technological innovations are used in all major business processes within a tourism enterprise, from finding and attracting customers as a communication and marketing tool, and ending with the formation of a tourism product.

Market innovations in field of health tourism are also associated with improving marketing strategies for promoting a tourism product, introducing new marketing communication tools (social media, online branding, dynamic pricing, targeting and market segmentation using modern information technologies). It is assumed that in the future the virtual connection of SPA and Wellness with clients will become much more creative, unique innovative forms of attracting customers to the network will appear, in particular, special diagnostic technologies and compiling individual programs online taking into account the specific characteristics of the client, consultations with a trainer or a cosmetologist in the mode real time. This trend of innovative development should also be adopted by Latvian companies operating in the field of SPA and Wellness tourism.

CONCLUSION

One of the significant problems hindering development of health tourism in Latvia is lack of innovation in the tourism industry, in particular health tourism sector. State policy in the field of tourism is aimed at solving this problem. An important role in the innovative development of health tourism today is played by Latvian health tourism cluster. However, for its successful development it is necessary to solve the number of problems, such as: problem of health tourism statistics in Latvia, formation Latvia's image as a destination for health tourism, determination of effective directions in marketing activities abroad. An important task is to solve the terminological certainty of health components tourism. Terminological certainty helps to classify certain types of wellness services and determine the direction of innovation in relevant field.

It is necessary to give a clear definition of SPA and Wellness tourism in Latvian Tourism Law, which are rapidly developing areas of health tourism, in which innovative component is most clearly expressed.

An important contribution of health development tourism is made by small and medium-sized businesses, which have limited financial opportunities for innovation and marketing, but at the same time are very flexible in responding to changes in market conditions and focusing on specific target segments.

An important task for the innovative development of health tourism is provision of enterprises with qualified personnel meeting market requirements. Standardization of SPA and Wellness services will also contribute not only to improve the quality of services provided, but also introduction of product and technological innovations.

An important role in process of introducing technological innovations can also be played by innovative start-up enterprises of rapid growth.

A solution to the urgent problem for Latvia in improving marketing strategies for promoting tourism product and introducing new marketing communication tools, also possible on the basis of relevant innovations.

In general, increasing innovation activity health field is possible on effective interaction between the state, science, education and entrepreneurship. Only in this way can the long-term competitiveness of Latvian health tourism on global tourism market.

Conflict of interests

The authors declare no conflict of interest.

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GLOBAL, ECONOMIC AND TECHNOLOGICAL TRENDS IN HUMAN RESOURCE MANAGEMENT DEVELOPMENT

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ABSTRACT

Background: A manager is the one who is responsible for accomplishing the tasks of the organization and who directs the efforts of the organization's employees for this purpose. In this paper, we will focus on one of the functions of management - the function of personnel management and on some trends that the 21st century has brought.

Objectives: of this paper is to explore and identify innovative ways and trends, global, economic and technological shifts in human resource management.

Methods/approach.: We have studied the experience that exists for effective and innovative use of freelancers, social networks and internet applications. We brought them in contact with a number of macroeconomic agents and set out directions and outlines for further research.

Results: In close collaboration with line managers, HR managers have been helping employers to find, hire, dismiss, administer and evaluate employees. However, there are trends in personnel management that substantially change perceptions of how well employers are coping with their HR tasks.

Conclusion: HR department's style and methods are constantly changing. Because of this, many employers are re-examining the organization of their HR functions. These types of HR centres carry out their activities through intranets (centralized networks) or centralized call centres;

Feedback, jokes, and game-specific targeting coincide with many new training apps, and websites such as Knack, Gild, and True Office allow an employer to incorporate game features in training, performance evaluation and recruitment.).

Keywords: HR management, Line manager, performance evaluation, technological & economical trends

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INTRODUCTION

A manager is the one who is responsible for accomplishing the tasks of the organization and who directs the efforts of the organization's employees for this purpose. According to most authors, management involves the implementation of five key functions. These include planning, organization, staffing, leadership and control.

In this paper we will focus on one of the functions of management - the function of personnel management and the trends brought about by the 21st century.

Human Resource Management (HRM) is the process of hiring, training, evaluating and compensating employees. It takes care of employees' business relationships, health, safety and justice.

Goals and objectives of the study: Increasing the usefulness and effectiveness is very important. It can guarantee that we can get results with the help of people. We can do everything right as a manager - build a brilliant strategy, craft a clear organizational plan, bring up-to-date technologies, and use sophisticated accounting controls - but all of this would be futile if we hired the wrong people or failed to motivate subordinates. On the other hand, many managers, starting with generals and ending with presidents, have succeeded without adequate plans, organizational charts and controls. They were still successful because of their ability to choose the right people for the job. The purpose of this work is to explore and identify innovative ways and trends, global, economic and technological shifts in human resource management.

Originality of the research - We have explored the experience of using freelancers' phenomenon, social networks and internet applications efficiently and innovatively. We brought them in contact with a number of macroeconomic agents. We have set out directions and outlines for further research.

The work consists of three parts:

- Chapter 1. Global trends,
- Chapter 2. Economic Trends.
- 2.1 Workforce trends
- Chapter 3. Technological trends.

Economic Trends. Although globalization has supported a growing global economy, serious difficulties have been identified in the world economy over the past 10 years. As shown in Figure 1. Gross domestic product (GDP) of the United States increased sharply during 2001-2017. During this period, real estate prices (see Fig. 2) also increased by 20% per year. Unemployment remained unchanged at 4.7%. Subsequently, in 2007-2008, all of these indicators worsened catastrophically. GDP has fallen. Real estate prices rose by 10 percent or more. Unemployment has exceeded 10% across the country.

It is difficult to explain why this happened. Many governments have changed the rules and regulations. Banking legislation in the United States and Europe, for example, has simplified rules that have prevented commercial banks from moving into new business, particularly investment banking. A giant, multinational, "financial supermarket" like Citibank has emerged. Fewer regulatory actions have resulted in more and more

companies' deep debts. The owners of the apartments bought the houses for very little money. Banks have freely lent finance to tenants to build more homes.

For nearly 20 years, American consumers have paid far more than they received. Lending has stopped. Many firms, companies, corporations and consumers have stopped buying. The economy has "sunk".

After all, this does not mean that there is no problem economy. On the one hand, the Great Recession of 2007-2009 has clearly attracted widespread attention. After the economic downturn, many companies refrained from investing in factories and buying equipment.

The financial crisis has made banks very cautious in issuing new loans. Starting a new business became very complicated.

After the world experienced 2007-2009, it is highly unlikely that deregulation, leveraging, investment banking and globalization, which had driven economic growth over the past 50 years, would again be a factor in growth.

2.1 Workforce trends:

The situation is compounded by the fact that the world workforce is growing more slowly than expected. This is bad because if employers do not have enough workers, they will not be able to expand. While this increase was 0.7% in the 2002-2012 decade (Ready D., Hill L, and Thomas R, 2014)? Why has the workforce slowed? Mostly because of the generation born after World War II. They became older. This period belongs to the period of demographic explosion. The current share of labour force participation in the current generation is declining. In other words, the percentage of the population that wants to work declines sharply. We must conclude, therefore, that economic growth will also slow down.

METHODOLOGY

We have studied the experience that exists for effective and innovative use of freelancers, social networks and internet applications. We brought them in contact with a number of macroeconomic agents and set out directions and outlines for further research.

RESULTS

In close collaboration with line managers, HR managers have been helping employers find, hire, dismiss, administer, evaluate employees. Nevertheless, there are trends in personnel management that substantially change perceptions of how well employers are coping with their It should be noted that the HR department's style and methods are constantly changing. Because of this, many employers are re-examining the organization

of their HR functions. HR tasks. Many plan to deploy technologies to implement a large number of shared services or transactional agreements.

They create a centralized staffing division, which is staffed across all departments of the company to assist line managers in personnel management. These types of HR Centers operate through intranets (centralized networks) or centralized call centers;

They are intended to provide managers and employees with specialized assistance in the day-to-day management of personnel. It is also possible to have corporate HR teams in the company. This helps senior management resolve important issues related to the development of staffing aspects of the company's long-term strategic plan.

DISCUSSION

"Talent management" is, recruiting, developing, retaining and resolving the company's workforce and it is main challenge.

An unbalanced workforce is another economic innovation. This is partly due to the fact that fewer and fewer people are looking for work. In addition, demand for the workforce is unbalanced. For example, the "average" unemployment rate, say 5%, is masked by the fact that the unemployment rate among college graduates is much higher. And the unemployment rate among software professionals is much lower.

Nearly half of US college graduates are employed in jobs requiring less than four years of college education. (Vedder R., Christopher Denhart Ch., and Robe J. 2019)

Why did this happen? Because most jobs created in the economy over the last few years do not require college education, and as the Bureau of Labor Statistics says (Bureau of Labor Statistics, "Economic Projections: 2012–2022 Summary"), this is likely to continue. About two-thirds of workers have been engaged in recent years with activities that do not typically require further schooling. (Ferris, 2022), typically do not require further college education to get a job. This will result in an unbalanced workforce in some professions. For example, unemployment in the high technology sector is low (Ferris, 2022), while in others it is very high (Ferris, 2022). Recruiters in some companies do not find suitable candidates, while in others there is a fall in candidates.

Today, the fact is that most workers are employed in services that are far below their competences. This explains why 70% of respondents said they were psychologically alienated from their jobs. In any case, the slowdown in the economy and the imbalance in the workforce mean that employers have to work hard to achieve the best results from their employees.

Chapter 3. Technological Trends. It is possible that technologies have identified the most up-to-date human resource management trends. For example, consulting firm Accenture (Accenture, "Top Trends That Will

Reshape the Future of HR.”) estimates that social media outlets such as LinkedIn make up to 80% of new recruits in a short time, and this is done by line managers bypassing the HR department.

Several basic types of digital technologies provide the transfer of functions from HR personnel to computers. Employers are increasingly using social media tools such as Twitter, Facebook, and LinkedIn. They also use new mobile applications, such as monitoring employee location and providing digital photos.

Websites such as Knack (<https://www.knack.com/>), True Office (<https://www.trueofficelearning.com/>) allow the employer to incorporate game features in training, performance, evaluation and recruitment.

Cloud computing and more intuitive user interfaces allow employers to monitor and report on how team goals are being implemented. It displays evaluation feedback in real time. Finally, data analytics mainly involves statistical methods, algorithms, data interrelationships, and problem solving. Talent analytics fundamentally changes how an employer looks for a new employee.

Retrospective talent analytics research shows that the following is significant: how grammatically correct their resumes were; that they did not drop out of school until earning a degree; they were successful at their previous jobs. Technological changes also affect the nature of jobs. When you talk about "tech work," everyone can imagine work at Apple and Google. But technologies apply to all kinds of work.

About 17 million people (Bloomberg BNA Bulletin to Human Resources Management, (2017), use information technology from a remote place to work at least once a month. Co-working sites offer freelancers access to office space, Wi-Fi, and office equipment.

Figure 1. US Gross Domestic Product, 1940-2010

Source: Bureau of Economic Analysis U.S. Department of Commerce, 2020

Figure 2. Key-Schiller Real Estate Price Index 1880-2020

Source: Federal Reserve Bank, 2020

Figure 3. US Unemployment Rate for 1970-2019

Source: U.S. Bureau of Labor Statistics, 2020

CONCLUSION

In close collaboration with line managers, HR managers have been helping employers find, hire, dismiss, administer, and evaluate employees. Nevertheless, there are trends in personnel management that substantially change perceptions of how well employers are coping with their It should be noted that the HR department's style and methods are constantly changing. Because of this, many employers are re-examining the organization of their HR functions. HR tasks. Many plan to deploy technologies to implement a large number of shared services or transactional agreements.

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Conflict of interests

The authors declare no conflict of interest.

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THE INFLUENCE OF PROFESSIONAL COMPETENCIES ON THE ECONOMIC CONDITION OF THE ORGANIZATIONS IN THE MECHANICAL ENGINEERING SECTOR IN BULGARIA

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ABSTRACT

The technological changes, under the influence of scientific and technological progress and trends in the mechanical engineering, inevitably lead to modifications in the characteristics of the existing jobs and the creation of new such with other characteristics. Therefore, regardless of the depth and speed of the changes in the technological facilities for production, ever more important for the efficiency in most machine-building enterprises will be the qualities and skills of the workforce in the coming years. Modifications in the parameters and organization of the workplaces will change the content of the tasks and as a consequence, will alter the vocational qualification requirements for the employed. In this sense, the development of the professional competencies is an important internal reserve for the economic growth of the organization. The purpose of this article is to analyze the status and development of the professional competencies of the labor force in the mechanical engineering sector, and to evaluate their role in improving the economic situation in the business organizations in Bulgaria.

Key words: professional competencies, mechanical engineering, economic condition, technological and economical trends, innovation and economic opportunities, development, innovations economics.

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INTRODUCTION

The membership The provision of the mechanical engineering in the country with the required quantity and quality of labor force is influenced by a number of external and internal risk factors - arising of new global financial and economic crises, negative alterations in the economic and institutional environment, factors related to changes in the the labor and management of the company, etc. The deepening shortage of highly skilled personnel is becoming a vivid risk problem for the mechanical sector. At some stage, the functional capacity (quality) of the workforce may not be sufficient to meet the ever growing demands of the new technologies, of the partners in the cooperative industries and of the markets.

The technological changes, under the influence of scientific and technological progress and trends in the mechanical engineering, inevitably lead to modifications in the characteristics of the existing jobs and the creation of new such with other characteristics. Therefore, regardless of the depth and speed of the changes in the technological facilities for production, ever more important for the efficiency in most machine-building enterprises will be the qualities and skills of the workforce in the coming years. Modifications in the parameters and organization of the workplaces will change the content of the tasks and as a consequence, will alter the vocational qualification requirements for the employed (Nikolova-Alexieva, Teneva & Yordanova, 2018; Sushchenko, 2016). In this sense, the development of the professional competencies is an important internal reserve for the economic growth of the organization.

Along with cost optimization, company innovativeness (Pukala & Petrova, 2019), depending on the adopted development strategy, each enterprise may use different policies and specific actions to meet the needs for staff with the required skills and competencies. In the context of financial constraints, it is important to focus on the internal reserves in the organization of all the workforce processes - forecasting the needs and expected changes in the required skills and competencies, optimizing budgets, selecting, evaluating, work pay and stimulus, vocational training and advanced training (Mikhailov, Karasev & Mikhailov, 2018; Levashova, 2011 ; Mussaripov et al, 2019; Zagorodnya et al, 2020).

Building a set of professional competencies of the workforce requires focused actions to improve certain knowledge, skills and abilities. (Uteubayev, Petrova & Lyubenova, 2018; Koval et al, 2019; Naama, 2010; Naama, 2018, Vazov, 2019). Their development has a direct or indirect impact on the results of the production and economic activity in the economic organizations in the mechanical engineering sector (Bacho et al, 2019; Lukjanova, Sushchenko & Zyma, 2019). This necessitates exploring the levels of development of the professional competencies of the employees, and revealing the possibilities for their further growth and enhancement. (Sushchenko & Basyuk, 2019 ; Naama, 2001 ; Naama, 2011).

In this regard, examining the level of the vocational competencies of the workforce in profit-making mechanical engineering companies can help clarify the power of the relationship between competence development and improvement and the ultimate economic outcome.

The purpose of this article is to analyze the status and development of the professional competencies of the labor force in the mechanical engineering sector, and to evaluate their role in improving the economic situation in the business organizations in Bulgaria.

The article is structured into two main sections. The first involves an analysis of professional competencies, examining the links with and relation to the production and economic performance. The second section presents a model of professional competencies which are particularly important for achieving high economic result in the businesses in the Bulgarian mechanical engineering sector.

MATERIALS AND METHODS

In order to assess the status of the professional competencies of the workforce, influencing and interacting with the production and economic results, the views of owners, managers and specialists in the human resources management /HRM/ in 68 varying in size, status and legal structure companies in the mechanical engineering sector were examined and analyzed. Most of them are located on the territory of Plovdiv, Haskovo, Pazardzhik and Stara Zagora regions.

By size, the surveyed business organizations are grouped into four groups, namely:

- 1 to 10 employees - 14.7%
- 11 to 50 employees - 38.6%
- 51 to 100 employees - 27.9%
- Over 101 employees – 18.8%

The selection of organizations in the field of mechanical engineering is based on the positive economic results achieved by them, or the realized profit for the last three years prior to the survey. The effect and interaction of the professional competencies affecting the size of profit in the organizations studied is examined using the Pearson correlation analysis. For the purposes of the above, the organizations are considered according to their legal form. The first type involves Sole Trader Organizations (ST). They are predominantly small in size and their production is mainly intended for the local markets. The second and third types are capital companies. Sole Owner Limited Liability Companies /Ltd./ and Limited Liability Companies /LLC/. In these businesses, the main factors for achieving.

The participants in the study has previously received a list of 20 major groups of professional competence as well as their concise definition and description. (Table 1). They were asked to rank them in a five-point scale, namely: 1 - not important, 2 - somewhat important, 3 - important 4 - very important, 5 - extremely important.

Table 1. Description of the main groups of professional competence

№	Competence	Description
1	Adaptability	Ability to adapt to the corporate culture, flexibility, quick orientation to the demands of the changing environment, including the ability to work under pressure and tight deadlines
2	Readiness and willingness to learn	Receptivity, curiosity, desire for self-improvement, seeking and receiving feedback
3	Loyalty	Ethical attitude, honesty, integrity
4	Efficiency	Ability to cope with work tasks with good results
5	Computer skills	Using word processors, spreadsheets, Internet applications

6	Leadership skills	Skills in planning, managing and motivating people, skills in decision-making, negotiation, etc..
7	Mathematical skills	Working with numbers, accuracy, methodical skills, precision
8	Ability to work in a team	Cooperation, conflict resolution, good interpersonal relations, sociability, ability to build relationships
9	Motivation	Positive work attitude, enthusiasm
10	Professional skills	Specific skills and knowledge of the professional field, an adequate idea of the work
11	Communication skills	Clear, convincing and literate expression in oral and written form
12	Critical attitude	Analytical skills, logic, impartiality, accuracy
13	Office skills	Finding and organizing information, documents, data; work habits and use of office equipment
14	Entrepreneurial skills	Initiative, entrepreneurship, business knowledge and insight, determination, ability to make decisions and take risks
15	Self-presentation skills	Skills for successful performance (including in a job application and interview), confidence in one's own skills, positivity, conviction, knowledge of business communication
16	Creativity	Creativity, initiative, ingenuity, lateral thinking
17	Technical skills	Specific skills to use specialized soft ware programs and equipment
18	Client attention skills	Responsiveness, empathy, positive attitude, tact, tolerance, patience, attentiveness
19	Self-management skills	Responsibility, independence, organization of time and work tasks
20	Multilingual abilities	Use (written and spoken) of a foreign language, intercultural experience and knowledge

The actual list has been prepared for the purposes of the study, in which the following were taken into account:

- **Key competencies** formulated by the European Commission¹;
- **Preliminary analysis** of similar studies in Europe and around the world in recent years²;
- Overview of the most frequently mentioned skills and qualities that are required from applicants in **job advertisements**³,
- **Consultations with employers**, educational experts and counselors who helped summarizing the skills in 20 groups^{4, 5}.

¹ Employers' perception of graduate employability, FlashEurobarometer, 2010 // http://ec.europa.eu/public_opinion/flash/fl_304_en.pdf

² Graduate Employability: What do employers think and want? 2008 // http://ec.europa.eu/education/higher-education/doc/business/graduate_en.pdf;

³ Lisbon Council – “Europe 2020: Why Skills are Key for Europe's Future”, <http://www.lisboncouncil.net/publication/publication/54-skillseuropersfuture.html>

⁴ Ready to grow: business priorities for education and skills. Education and skills survey, <http://www.cbi.org.uk/ndbs/content.nsf/802737AED3E3420580256706005390AE/C4393B860D00478E802576C6003B0679>)

⁵ The Definition And Selection Of Key Competencies, http://www.oecd.org/data_oecd/47/61/35070367.pdf

The second section presents a model of professional competencies of the workforce. It addresses those that are of particular importance for achieving high economic performance in the business organizations in the mechanical engineering sector. To build this model, the Path-coefficient analysis technique was applied. This method combines the capabilities of the correlation, regression and structural analysis. This makes it one of the most appropriate methods of studying relationships, as Path-analysis examines not only the direct but also the indirect links between the state of the professional competencies of the human resources and the economic performance of the organizations. In this way, those with the strongest impact are assessed, while the weak ones are eliminated.

The survey covers the period October 2018 - January 2019. The data and information are collected through direct contact and completion of specially developed questionnaires for the purposes of the analysis. Moreover, the interview method is used to clarify the information. The data processing and analysis uses the statistical package SPSS 13.0 and Microsoft Office (Word, Excel, Power Point).

RESULTS AND DISCUSSION

Research on the professional competencies of the workforce, influencing and interacting with the economic results in the business organizations in the mechanical engineering sector

The analysis of the data reveals that in the organizations of the mechanical engineering sector Professional skills $R=0.839$ at $\alpha=0.01$ has the strongest influence on the final economic results. Its influence is particularly significant in Sole Owner Limited Liability Companies. They have a very high correlation coefficient of 0.879, statistically proven at $\alpha = 0.01$. The importance of the Professional skills is also proven at SL $R=0.755$ at $\alpha=0.01$ and LLC $R=0.806$ at $\alpha=0.01$. (Table 2.)

Table 2. Impact of the professional competencies on the economic situation of the business organizations in the mechanical engineering sector

Professional competence	Correlation coefficients			
	Total	SL	Ltd.	LLC
Adaptability	0,694**	0,503**	0,724**	0,661**
Readiness and willingness to learn	0,787**	0,683**	0,821**	0,736**
Loyalty	0,407	0,383	0,301	0,337
Efficiency	0,628**	0,643**	0,479*	0,618**
Computer skills	0,446*	0,341	0,455*	0,436*
Leadership skills	0,264	0,299	0,238	0,254
Mathematical skills	0,197	0,126	0,257	0,123
Ability to work in a team	0,728**	0,488*	0,831**	0,669**
Motivation	0,584**	0,593**	0,631**	0,477*
Professional skills	0,839**	0,755**	0,879**	0,806**
Communication skills	0,514*	0,424	0,663**	0,498*
Critical attitude	0,297	0,203	0,296	0,211

Office skills	0,336	0,418	0,347	0,223
Entrepreneurial skills	0,247	0,211	0,278	0,286
Self-presentation skills	0,511*	0,458*	0,416	0,379
Creativity	0,374	0,479*	0,316	0,351
Technical skills	0,228	0,184	0,263	0,191
Client attention skills	0,423	0,407	0,445*	0,331
Self-management skills	0,672**	0,537*	0,716**	0,658**
Multilingual abilities	0,694**	0,503**	0,724**	0,661**
Respondents, %	100	33,6	36,8	29,6

Source: Own calculations

*Correlation is significant at the 0.05 level; **Correlation is significant at the 0.01 level

Of particular importance for the positive economic outcome is the Readiness and willingness to learn. The data show that this competence most significantly influences the capital companies, with correlation coefficients of 0.821 and 0.736 respectively at $\alpha=0.01$. Similar results are also observed with SL holdings.

Professional competencies, such as Ability to work in a team / $R=0.728$ /; Adaptability / $R=0.694$ /; Self-management skills / $R=0.663$ /; Efficiency / $R=0.611$ / and Motivation / $R=0.576$ / also have a strong impact on the final economic performance of the organizations in the engineering sector. The high correlation coefficients, statistically proven at $\alpha=0.01$, reveal their role in achieving higher production and economic results in the business organizations in focus. A strong correlation with profit is also observed in Computer Skills / $R=0.449$ at $\alpha=0.05$ / and Communication skills / $R=0.524$ at $\alpha=0.05$ /, Self-presentation skills / $R=0.496$ at $\alpha=0.05$ / as well as Multilingual abilities / $R=0.523$ at $\alpha=0.05$ /.

With Limited Liability Companies, Adaptability / $R=0.674$ /, Ability to work in a team / $R=0.667$ /, Efficiency / $R=0.623$ /, Self-management / $R=0.672$ / and Multilingual abilities / $R=0.597$ / are particularly important for enhancing the production and economic performance. Their interaction with the profit made shows high correlation coefficients, statistically proven at $\alpha=0.01$. Computer skills, Motivation and Communication skills also play an important role in rising the economic performance of these organizations.

The Sole Owner Limited Liability Companies demonstrate similar results. A strong correlation is evidenced between the professional competencies Adaptability / $R=0.724$ at $\alpha=0.01$ /, Ability to work in a team / $R=0.831$ at $\alpha=0.01$ /, Motivation / $R=0.631$ at $\alpha=0.01$ /, Communication skills / $R=0.663$ at $\alpha=0.01$ /, Self-management skills / $R=0.716$ at $\alpha=0.01$ / and Multilingual abilities / $R=0.668$ at $\alpha=0.01$ / and the high production and economic performance of the organizations in mechanical engineering.

In SL companies, the enhanced economic performance is highly dependent on Efficiency / $R=0.643$ /, Adaptability / $R=0.503$ / and Motivation / $R=0.593$ /.

The impact of these professional competency groups is statistically proven at $\alpha=0.01$. With Ability to work in a team / $R=0.488$ /, Self-presentation skills / $R=0.458$ /, Self-management skills / $R=0.537$ /, Creative skills / $R=0.479$ /, and Multilingual abilities / $R=0.437$ /, there is also a strong positive interdependence with good production and economic results. This is confirmed at $\alpha=0.05$.

From the data displayed, it can be concluded that a number of similar results are observed when examining the interrelations and links of the professional competencies with the production and economic performance of the three types of companies according to their legal and organizational form.

Adaptability, Professional skills, Readiness and willingness to learn, Self-management and Motivation are competencies which are of particular importance for profit making in both, capital companies and SL organizations.

There is a slight difference in the power of influence in terms of Ability to work in a team, Communication skills and Multilingual abilities. They are rated as particularly important in the organizations of the capital companies, while their influence at the SL is weaker.

In SL organizations, the relationship between Self-presentation skills and Creative Skills with the declared profit is statistically proven at $\alpha=0.05$. At these companies, these professional competencies are not particularly significant.

The Client attention skills is a substantial professional competency for the Sole Owner Limited Liability Companies. In the organizations of SL and LLC the Efficiency of the workforce is of particular importance for increasing the economic results.

At the analysis of the rest of the professional competencies, we did not establish a statistically proven correlation between them and the profit made during the research period. Medium and low levels of correlation coefficients are reported, while the least important for achieving positive economic results in the business organizations in the mechanical engineering sector are Technical skills and Mathematical skills.

The analysis reported shows the relationship and the impact of the presented professional competencies on the economic situation of the businesses in the mechanical engineering sector. On the basis of this, a combination of competencies with the greatest impact on the economic situation of the business organizations can be proposed.

Modeling of the professional competencies which directly or indirectly affect the economic situation of the business organizations in the mechanical engineering sector

The Path-analysis method was applied to study the impact of both, the direct and indirect links of the professional competencies on the economic status of the business organizations in the mechanical engineering sector. This method assesses only those competencies which exercise the strongest impact on the economic performance, while the weak ones are eliminated. The results obtained from the performed Path analysis are shown in Table 3.

The information in the table reveals that some of the professional competencies have a positive direct and indirect impact on the economic status of the organizations studied. These competencies are rated as very positive.

Table 3. Direct and indirect effect of the professional competencies affecting the economic condition of the business organizations in the mechanical engineering sector

Professional competence	Path-coefficients	
	Direct effect	Indirect effect
Professional skills	0,549	0,290
Readiness and willingness to learn	0,916	-0,129
Creativity	-0,366	0,740
Efficiency	0,464	0,164
Self-presentation skills	0,725	-0,214
Adaptability	0,521	0,173
Multilingual abilities	0,869	-0,272
Ability to work in a team	0,491	0,237
Communication skills	0,807	-0,293
Motivation	0,477	0,107
Critical attitude	-0,367	0,664
Self-management skills	0,476	0,196
Entrepreneurial skills	-0,208	0,455
Loyalty	0,644	-0,237
<i>Own calculations</i>		

These include Professional skills, Efficiency, Adaptability and Ability to work in a team. The professional competencies Self-management and Motivation skills are also very positive.

Self-presentation skills, Readiness and willingness to learn, Communication skills, Multilingual abilities and Loyalty have a direct positive effect on the economic status of the organizations in the engineering sector. However, the indirect impact of this group of professional competencies on the overall economic performance is negative.

Figure 1. Model of the professional competencies having a direct and indirect effect on the economic situation of the business organizations in the mechanical engineering sector

The third group of professional competencies, to which the Creative skills, Critical attitude and Entrepreneurial skills apply, have a direct negative impact on the economic situation of the businesses in the mechanical engineering sector. On the other hand, their indirect influence is very positive. The coefficient of the indirect effect exceeds that of the direct and the ultimate influence of these competencies is also positive.

The modeling of professional competencies, which have a positive impact on the economic situation, helps to establish a complete system for the selection, training and professional development of the managers and employees in the business organizations in the mechanical engineering sector. (Figure1.)

The implementation of the system shows the effect of the practical application of the professional competencies, as well as their action and interaction for improving the economic status of the businesses. Their sophistication has helped to improve communication and relationships between all employees of the business organizations. The motivation of the human resources is increased to reach better performance of the work tasks. The achieved result of the implemented activities is the introduction of a legally established and effectively functioning system for the selection, training and professional development of the workforce, contributing to the improvement of the economic status of the companies in the field of mechanical engineering.

CONCLUSIONS

Building a set of professional competencies requires focused work to improve certain knowledge, skills and abilities. They have a direct or indirect impact on the results of the production and economic activity in the business organizations in the mechanical engineering sector. It is therefore of the utmost importance to examine the state of professional competencies by opening up opportunities for their effective use and management.

The analysis reported hereby shows the relationship and the impact of the presented professional competencies on the economic status of the companies in focus. Based on this research, a combination of competencies which have the greatest impact on the economic performance in the organizations can be proposed.

The modelling of professional competencies, which have a positive impact on the economic situation, contributes to the establishment of a complete system for the selection, training and professional development of the workforce in the business organizations in the mechanical engineering sector.

Conflict of interests

The authors declare no conflict of interest.

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WHETHER WE NEED EMOTIONS IN BUSINESS OR NOT

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ABSTRACT

Background: Modern areas of applied psychology, including management psychology, traditionally distinguish two main groups of organizational efficiency indicators: productivity and socio-psychological. Productivity indicators, volume, and quality of manufactured products, the intensity of production process, rhythm, sales volume, market expansion, creation of new customer networks, etc. All such indicators are usually expressed in numbers and are easy to estimate, but how to measure social efficiency indicators: Teamwork, employee collectivism, their attitude towards personal and professional growth, high-quality relationships with each other, are quite difficult to assess. This is why more and more attention is being paid to the use of intangible assets, particularly the utilization of emotional resources, in business.

Objectives: To identify emotions experienced and expressed, to assess the strength of emotional workload in the work process, and to determine how emotions combined with business goals.

Methods/Approach: While conducting and planning the research statistical methods, both on the principle of sampling and non-sampling were included.

Results: Research showed that the effectiveness of the management process is improved if the official leader is recognized by the members of the working group as the leader

Conclusions: In modern conditions of development, the leader is required not only to perform basic managerial functions but also to select the right team, to create the necessary emotional impulse to achieve the set goal. In other words, a modern leader should not only be a leader but should also be an emotional leader.

Keywords: Intellectual ratio, emotional ratio, emotion, logic, business

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INTRODUCTION

In modern business, issues such as cost reduction, profit growth, reaching a consensus with a partner, gaining a competitive advantage, finding ways to solve problems creatively, or improving product quality are becoming more and more important every year. The heads of companies have a big burden on their shoulders to solve these problems. Especially when the methods of increasing the efficiency of the company are getting older every year. In such a situation, the effectiveness of business relationships depends on the timely fulfilment of the goals set by the company's executives (Galanina et al, 2017; Shamilishvili, 2019; Zaverbnyj, Redina, & Matseliukh, 2019; Kurmanov et al, 2018; Petrova et al, 2020). Mainly the goals that are achieved

by the joint efforts of the employees of the organization. Successful work in a team, of course, depends on the ability of employees to do their job efficiently and consistently. At the present stage of business development, abstract and obscure theses such as "teamwork", "improving communication skills", "focusing on results" and "striving for development" not only instead of motivating employees, irritate them. A clearer algorithm of action needed: what, how, and when to do in order to develop organizational efficiency growth methods and rise to a new level.

Modern areas of applied psychology, including management psychology, traditionally distinguish two main groups of organizational efficiency indicators: productivity and socio-psychological (Cherniss & Adler, 2000). Productivity indicators, volume, and quality of manufactured products, the intensity of production process, rhythm, sales volume, market expansion, creation of new customer networks, etc. All such indicators are usually expressed in numbers and are easy to estimate, but how to measure social efficiency indicators: Teamwork, employee collectivism, their attitude towards personal and professional growth, high-quality relationships with each other, are quite difficult to assess (Arsawan, 2019; Baklanova, Petrova & Koval, 2020; Drobnic, Toros & Weis, 2020; Gechbaia, Kharaishvili & Mushkudiani, 2019). This is why more and more attention is being paid to the use of intangible assets, particularly the utilization of emotional resources, in business.

Human life is full of a variety of emotions, but all of them are directly derived from the basic emotion or represent a combination of several basic emotions. Many academic papers scientifically research emotions (Barsade & Gibson, 1999).

Well-known psychologist and emotional researcher Paul Eckman focuses on seven basic emotions (interest, joy, sadness, anger, disgust, fear, and surprise) (Ekman, 2003) Theorist Robert Plutchik discusses initial eight emotions and a whole range of similar emotions (Plutchik, 2001). According to Plutchik's theory, emotions are evolutionary mechanisms that play an important role for humans to adapt and survive in the external world. According to this view, the function of each emotion is to stimulate adaptive behavior: emotion is followed by a natural impulse that is expressed in a particular behavior. These mechanisms are genetically determined and work automatically - managing and pushing people to respond to external stimuli. There are 8 main (prototypical) emotions: Anger, fear, sadness, joy, disgust, surprise, confidence, and interest. The model of basic emotions is not only an interesting and curious theory but also helps people understand their psycho-emotional dynamics and self-organize. Taking this model into consideration businesses can more productively use impulses emanating from employees' emotions redistribute energy resources in the required direction.

According to D. Goleman, a professor at Harvard University, the great revolution of the 21st century is the revenge of the senses on the intellect (Boyatzis, Goleman & Rhee, 2000). If earlier the IQ showed the ability to succeed in a particular professional activity, today it prefers the emotional ratio (EQ). Numerous studies have shown that the best employees are not only "graduates" of prestigious universities, but also people with high emotional intelligence (Gole, 2001).

Because they are well aware of other people's emotions and they can manage their emotional field, their behaviour is more adapted to society, they can easily achieve their goals, and overall, they influence a prospect of a long-term partnership with customers. Thus, researching and analyzing emotions in business practice is becoming more and more relevant.

METHODOLOGY

To identify emotions experienced and expressed, to assess the strength of emotional workload in the work process, and to determine how emotions are combined with business goals, for employees in various companies in the public and private sectors, a marketing survey was conducted by Akaki Tsereteli State University's Business Administration Department. The purpose of the survey was to ask as many people as possible by the authors. Respondents were workers who are working in different positions in Kutaisi. The questionnaire was based on metric and nominal variables, and most of the questions were close-ended. 342 respondents were interviewed. Respondents selected based on statistical methods, both on the principle of sampling and non-sampling. Care has been taken to ensure all material included in the analyses is anonymous, unattributable and conforms to ethical research guidelines.

RESULTS AND DISCUSSION

This research specifically focuses on the more subtle forms of emotion, which are harder to detect and respond to the questions:

1. To the question: "Which emotion do you have the most in the process of work" the answers of the respondents were distributed as follows: Anger 12%, fear 13%, sadness 9%, love 27%, joy 14%, disgust 4%, surprise 5%, interest 26%. (fig.1)
2. To the question "Can you talk openly about emotions and feelings in the company?", a significant part of the respondents (35%) think that "can not", "emotions are neglected" 30% of respondents answer, "emotions are suppressed" say 25% of respondents, 10 % of respondents believe that "Touch" with emotion should not be at all", otherwise you will have problems.
3. Respondents' answers to the question: "What do you think are the consequences of neglecting employees' emotions?" answers were as follows:

"Staff is less loyal to the company" (12%). The work environment is stressful (12%), employees often get sick "on a nervous basis" (12%).

4. It was interesting to find out how employees feel after work hours. The majority of respondents (31%) say, they are "tired and unenergetic," after the end of the work hours, 20% of the respondents think that they are "more emotionally and mentally tired, rather than physically". 6% of respondents answer: "Work emotions interfere with personal relationships." "Positive emotion follows me from work" admits only 7% of respondents.

Figure 1. Emotions in the process of work

Source: Own computations

5. The question: "Name the causes of stress" offered 17 options for answers. The first five answers to causes of stress are:

"Low living standards" (12%), "Routine life with little emotion" (27%), "Lack of money and various bank debts" (15%), "Conflict situations with employees and other people" (12%), "Impossibility of quality rest" (20%), "Chronic diseases" (4%), "Excessive physical and mental load" (10%).

6. To the question: In your opinion, what kind of emotions do the managers of the company express in their relationship with their subordinates?

Anger emotion (28%), fear (18%), melancholy (5%), joy (10%), disgust (5%), surprise (8%), confidence (13%) and interest (15%). (fig.2)

Particularly alarming is the fact that the emotions of anger prevail in the emotions expressed by the subordinates of the managers. Clearly, anger produces only aggression and fear, which in turn causes stress. Stress is nothing more than an excessive state of emotion of expectation or fear. As research shows, stress factors can be divided into two groups: organizational factors associated with working in a company and personal factors related to the personal lives of employees. We believe that stress is an unavoidable condition for the development of a business, but managers need to be able to identify the factors that cause stress, come up with protective mechanisms in a timely manner, and manage stress effectively.

Figure 2. Emotions of the managers of the company express in their relationship with their subordinates

Source: Own computations

7. To the question "How do you think the company's microclimate will change based on the open expression of emotions and proper management of emotions?", "Employee interaction process will be effective" answer 18% of respondents, management decisions will be adequate - 27%, work productivity will increase - 20%, working microclimate will become positive - 18%, conflicts will decrease - 17% (Fig.3).

Figure 3. Emotions and the efficiency of the work of companies

Source: Own computations

The research confirms that the topic of emotional management and emotional intelligence is quite new in Georgian business practice, so it is advisable to train employees in managerial positions in business fields to develop emotions and emotional knowledge and skills, to achieve emotional and intellectual growth. Managers who ignore the emotional component of management spend a lot of energy and health on artificial "masks", but they lose important information about themselves and the outside world. At the same time, the basis for all kinds of long-term cooperation is the understanding of others, their goals, and their values. The relationship between trust and organisational performance has been proven in a number of previous studies, so it can be stated that informal knowledge/information sharing (workplace gossip) with false information adversely affects organisation trust, and, through it, organisational performance. Using well-chosen indicators and parameters, the economic consequences can be quantified, which will be presented in a later study.

The research also highlighted that, although formal information/knowledge sharing within organisational functioning is more typical, (thanks to Operational Regulations and Organisational Policies), than the informal mode, people very often are emotional at work. Even if the results make you aware of the negative effects of such informal ways of information/knowledge sharing on the development of culture, emotional relationships, organisational operation, performance and effectiveness.

CONCLUSION

The study showed that the effectiveness of the management process improved if the members of the working group as the leader recognize the official leader. In modern conditions of development, the leader is required not only to perform basic managerial functions but also to select the right team, to create the necessary emotional impulse to achieve the set goal. In other words, a modern leader should not only be a leader but should also be an emotional leader.

Every day managers get huge amounts of information, the volume of which is constantly increasing. It is impossible to say that emotion and emotionality are better than logic and rationality, however, the results of the study completely deny the generally accepted view that emotions should be completely excluded from business activities, moreover, close, coordinated mental work with emotions can improve not only the professional, communicative and social skills of employees, but also meet and maintain the high level of customer needs.

The emotion inherent in the work did impact on service providers. Occasionally felt mood differed from that which respondents were able to display and they had to suppress their own feelings while caring for or managing the emotions of others.

Conflict of interests

The authors declare no conflict of interest.

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Monograph Review

MANAGEMENT IN THE FIELD OF WASTE MANAGEMENT IN THE CONDITIONS OF TRANSITION TO THE CIRCULAR ECONOMY IN UKRAINE

by authors Viktor Koval, Inessa Mikhno and Mariana Petrova

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The impact of economic activity on the environment and the widespread use of clean technologies will continue to play a key role in the pursuit of environmentally friendly processes with minimal waste, but in Ukraine there is still a tendency to increase landfill areas and a low level of environmentalization of society. This argument indicates the relevance and timeliness of the monograph "Management in the field of waste management in the transition to the circular economy in Ukraine", the scientific results of which indicate the solution of a number of theoretical and methodological issues on improving the organizational and economic foundations of household waste disposal and the development of a non-linear economy.

Despite theoretical and empirical scientific studies on changes in the ecological state and resource-saving technologies, there are currently no fundamental works devoted to strictly analyzing the implementation of the circulating economy in Ukraine and the main factors that make up the region's information and legislative environmental policy; there is no clear model for determining the introduction of a circulating economy.

The practical results of the monograph are the basis for changes in solving the problem of the negative impact of landfills on the ecosystem and become the basis for the formation of modern legislation and a waste monitoring system in Ukraine. Due to the fact that economic development contributes to an increase in the environmental burden, it is necessary to further improve environmental legislation to solve the problem of environmental pollution. This is especially true for waste, the amount of which is constantly increasing, and the composition is changing in favor of materials with a long decomposition time.

The methodological approach developed by the authors to improve the methodology of anthropogenic environmental impact is the basis for calculating social expenditures at the regional level, since environmentally hazardous technologies and development due to environmental degradation prevail in Ukraine.

Acquaintance with the contents of the monograph by Viktor Koval, Inessa Mikhno and Mariana Petrova allows us to make a general conclusion that this monograph is a logically constructed and completed study. The main scientific provisions, conclusions and suggestions presented in the work are justified and reflect the contribution to the substantiation of theoretical and methodological approaches to the organizational and economic foundations of waste management in the implementation of a circular economy.

The author's scientific novelty consists primarily in substantiating the current situation in the field of waste management from the perspective of maximizing public welfare, creating models of anthropogenic impact on the ecosystem and models for analyzing the degree of introduction of the circular economy in the country, which contribute to the introduction of new environmentally and economically sound technologies in Ukraine.

In the applied aspect, it represents the conceptual basis developed by the author for the formation of a model for calculating the anthropogenic impact on the ecosystem and forecasting the introduction and development of a closed-loop economy in Ukraine, which is based on the scientific, technological and innovative development of resource-saving systems based on the formation of the waste processing and utilization industry. The experience of the developed countries of the world indicates the possibility of achieving significant economic, environmental and social effects through the formation of the waste management industry and turning it into an integral element of the socio-economic infrastructure of regional economies.

The reliability and validity of the research results are confirmed by the use of a significant number of sources of scientific information, statistical reporting data, a wide range of research methods.

The monograph by Viktor Koval, Inessa Mikhno and Mariana Petrova “**Management in the field of waste management in the transition to the circular economy in Ukraine**” is a significant contribution to the development of the economic science of Ukraine, it is a complete scientific research carried out on a relevant topic, has scientific and practical value. The practical value of the monograph is due to the fact that the scientific results of the study systematically cover various aspects of the development of the national economy and the fundamentals of waste management, can be useful for representatives of state authorities, specialists, at the scientific and practical levels they solve the formation of economic and environmental politicians, business leaders in the field of waste management, as well as scientists.

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Each university needs objective data for assessment of the science, for making decision for further development.

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- Each journal website has informational sections – description of the journal subject, editorial board, review policy, open access policy
- Each journal website has a contact page to contact the journal team
- Each journal has an archive with all the issues and their articles
- Each journal website has a search functionality only in the context of the journal, results from the rest of the platform are not included
- By request each journal structure can be customized
- Journal websites are built in English, but by request they can be customized to be multi-language
- The main platform website has links to each journal website
- The main platform search and browse functionalities include all issues and articles from the journal websites, linking to them
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- Each journal administrator has access to a control panel to administrate their content and upload new issues
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