

UDC 658.5  
УДК 658.5

## BUSINESS ACTIVITY IN THE CONDITIONS OF NONLINEAR DYNAMIC FOR SOCIAL AND ECONOMIC DEVELOPMENT OF SOCIETY

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## ПІДПРИЄМНИЦЬКА ДІЯЛЬНІСТЬ В УМОВАХ НЕЛІНІЙНОЇ ДИНАМІКИ СОЦІАЛЬНО-ЕКОНОМІЧНОГО РОЗВИТКУ СУСПІЛЬСТВА

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## ПРЕДПРИНИМАТЕЛЬСКАЯ ДЕЯТЕЛЬНОСТЬ В УСЛОВИЯХ НЕЛИНЕЙНОЙ ДИНАМИКИ СОЦИАЛЬНО-ЭКОНОМИЧЕСКОГО РАЗВИТИЯ ОБЩЕСТВА

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**Problem setting.** Business activity in the modern world and in our country has to be carry out under conditions of systemic, constantly growing uncertainty and variability of social and economic environment due to current features of scientific and technological development and globalization of economic business. It increases the importance of the efficient management of business financial and economic activity. It requires theoretical analysis of world's social and economic mechanisms and demands for the developing of new approaches for business organization.

**Recent research and publication analysis.** In general, the development of the theory of business and economic theory is mainly related to the evolution of exchange, production and distribution of goods and services, and to the level of science and technology development.

The development of contemporary economic and business concept was closely related to the progress of neoclassical natural history at the late 19th - mid 20th centuries. This time was *highlighted* by the revolutionary changes in physics (such as atomic structure theory, stochastic theory of Brownian motion, quantum mechanics and relativistic quantum mechanics), cosmology (the concept of dynamic Universe), biology (genetics), and the birth of cybernetics [1]. Results of studies of the stochastic motion of molecules in gases and investigation of elementary particles promoted the development and wide recognition of probabilistic determinism concept. The concept became an impetus for the further progress of neoclassical economic theory and also for the formation and development of Keynesianism and its various modifications. At this time idea that the economic system includes random (stochastic) processes which are not strictly determinated became widely accepted. These processes lead to instability, uncertainty and unpredictability of the global market and the entire economy.

Schumpeter's studies (see, for instance, [2]) made great impact on the development of the neoclassical theory of entrepreneurship in the 20th century. J. Schumpeter was the first one who put the entrepreneur in the center of the economic development, highlighting innovation as the main feature of business. He emphasized that companies are operating in the conditions of spontaneous and unpredictable changes in the business environment. The companies must to adapt new situations on the market and they

have to do it in their own way. It ultimately results in getting advantages only for some companies in the business competition. Because of that, J. Schumpeter viewing the business as an activity which involves a conscious disturbances in the economic environment to obtain a competitive advantage and, consequently, to get high profit. Innovation is a source of competitive advantage, since innovation creates the novel combination of different industrial and market mechanisms which often already present on the market.

Marshall developed similar ideas related to the business activity. He postulated that novel methods of the reproduction management and the use of innovative technologies create the new combination of production factors. In according with that, new and improved combination of factors are selected by objective analysis based on factor's competitiveness and viability potential [3].

It's worth to mention the studies performed by Knight F, who developed the theory of the risk, unmeasured uncertainty and also described the relationship between the risk and the profit in business [4]. He first linked unmeasured uncertainty to the risk of stochastic changes in the economy.

Despite the revolutionary discoveries in natural science in the XX century, the majority of studies of macro-, microeconomics and entrepreneurship contain methodological flaws. Economic systems in these studies are considered to be isolated and economic process stays in equilibrium with stochastic slow (i.e. linear) variability [5]. Such approach was often used to create a self-sustaining model describing development of economic processes. These findings consider the business process as closed microsystem acting in the conditions of risk. The further development of the business theory was induced by changes in the economic paradigm and by nonlinear, nonequilibrium (synergistic) processes in the economic theory (see for instance [5] – [9]).

This stage of the business theory began mainly in the last third of the 20th century. It was established by the studies of Drucker P., Gibb A., Kohl A., Pinchot G. and the other scientists (see, for instance, [10]). Research at that time was primarily focused on the mutual interaction of the entrepreneur and his business environment. Entrepreneur's environment includes elements of both micro- and macro-environment of business process which is interactive, nonlinear, and nonequilibrium. It's also important to emphasize works ([1], [10] – [12]) which described the development of the business theory within the synergistic (nonlinear) theory.

The research objective of this study is to identify the major determinants of nonlinear economic development within the framework of system analysis. Study will provide theoretical justification of these factors and investigate influence of the factors on the modern entrepreneurship activity.

**Key research findings.** We recognize the important effect of the stochastic component on the dynamics of natural, social, economic, scientific, technical and technological processes. However, we believe that the main hallmark of modern civilization development is its non-linear and unbalanced behaviour. It should be noted, that so far there is no comprehensive analysis of the impact of non-linear dynamic factors on the behaviour and properties of modern entrepreneurship in the literature.

We will conduct this analysis under settings of universal evolutionism as the main paradigm in the modern post neoclassical science [13].

We will perform this analysis in the frameworks of the theory of the dynamics of complex systems. First, we will analyze the basic properties of non-linear systems of any nature under their development, interaction and exchange between matter, energy and information [5], [14]. It should be outlined, that the process of social reproduction associated with the interaction of goods, money, work, managing information and other economic components can be considered as the economic counterpart of this system [15]. Economical subjects are present in the hidden form in all three components at this level, namely: they offer their assets on the market (it is financial component), they carry out the labor activity (energy component) and they control the process of reproduction (information component) [15].

From the most general point of view, the system is non-linear if its responsiveness to changes in the internal or the external environment is not adequate to the magnitude of these changes. This may lead to the implementation of fast, even intermittent processes in the evolution of such system. A critical determinant for the development of a certain system is its openness, since according to the Clausius's inequality the most probable state (i.e. state of equilibrium) for a closed system is the chaotic state with the maximum of entropy [16]. Thus, the non-linear nature of the open dynamic systems suggests the presence of strong interaction between internal and external components of the system and also the presence of complex, non-linear positive and negative relationships between them. This, in turn, leads to the developing of such key features of non-linear system as dependence of system parameters (environment) on the magnitude of the disturbance, and the formation of unstable local equilibrium states and non-equilibrium processes during the

system transition from one steady state to another. Another feature of non-linear system is that if the system will be forced off the local unstable equilibrium, the increase in the amplitude of this shift is non-linearly depends on the value of perturbation. Progressive increase in the amplitude of system shift far from equilibrium state can lead to the entire destruction of the system. Therefore having a non-linear upper limit of amplitude perturbations is a key mechanism preserving of sustain system development under conditions of the limited energy resources. The limit can be achieved through openness of the system by introducing of negative changes in the entropy outside of system. These changes will lead to generation of the global stable system and will be accompanied by formation of set of inner system's functional structures [15]. The formation of functional structures will be determined by system's self-organization, i.e. due to synergistic effects.

The presence of bifurcation is one of the most important features of non-linear system. Bifurcation is a discrete set of potential alternative ways of developing a system that determines its irreversible evolution. The highest sensitivity of system behaviour to external or internal disturbances is observed in the bifurcation points.

To analyze the modern business, it is important to outline that the main factors that determine, in our view, remarkable non-linear dynamic behaviour of social and economic development of society at the end of XX - beginning XXI century are the following:

- accelerated scientific and technological development;
- formation of information society;
- globalization of social and economic processes.

In fact, accelerated scientific and technological development led to appearance and formation of science-derived technologies (i.e. technologies based on a combination of theoretical basic science and advanced technological knowledge) at the end of the XX century and at the beginning of the XXI century. There are two relatively independent directions in this process: 1) technologies aimed to transform the nature (including high-tech technologies, informational component) and 2) technologies focused on manipulation and management of individual and collective conscious (high-hume technologies - information component) [13], [17]. Combination of these components created a unified system and this system now in turn integrates other technologies. This mechanism become the most important determinant contributing into scientific and technological development.

Increased amount of retired knowledge documents is a most evident sign of accelerated scientific and technological development. The time period for the knowledge to be searched and requested by subjects is constantly decreasing and the retired knowledge is quickly replaced by new one. It results in the reducing of knowledge "life cycle", i.e. decreasing the period from knowledge inception to practical usage. This, in turn, speed up the process of changing the generations of technology based on the appearance of the new generation of relevant knowledge. For example, "life cycle" of technology was 4-5 years and sometimes 7-10 years in the industrial era. Currently, the key specifications of superpowerfull integrated circuits in microelectronic, a key area of economic development, undergo two-fold improvement annually with a 30% reduction in costs and prices [18], [19].

Another important outcome of accelerated scientific and technological development is the creation of significant amount of new factors of production (and their combinations) which based on an entirely novel knowledge. These factors are also become increasingly involved into economic circulation. Thus, nanotechnology, information and telecommunication industry are all based on science-derived technologies and they formed the backbone of the modern hi-techs during the past two decades. The revolutionary discoveries in physics, biology, and cybernetics led to the development of these technologies and have created a number of innovative jobs: molecular and genetic engineering, cell medicine, web-technology and web-design management, etc. Indeed, innovations in the industry have to be based on the novel or significantly updated knowledge to better understand and explore the natural resources. Therefore, new industrial technologies are usually more productive compared to previous ones. Thus, the productivity of industry is increasing from generation to generation and it mediates the proper increase in the productivity of labor [18].

The analysis shows that the following major determinants lead to the appearance of extremely rapid and unbalanced, bifurcational changes in all aspects of social and economic development, including entrepreneurial activities: new technologies of production and management, new basic types of products and novel consumer and social standards with reduced life cycle. These changes also resulted to tight competition between subjects of business on micro- and to macro levels.

The current status of the world economy is characterized by changes in the structure and power of the factors that determine the level of competitiveness. In particular, there is a tendency to reduce opportunities for elevated volume of production. It includes increasing employment and involvement of larger amount of natural resources in the production. It also includes the change in the meaning of price competition and the impact of price and currency on the production [20] (Nechepurenko, 2001). Labor productivity, level of employee's skills and innovative technologies are become important determinants of the production.

Innovation is a well-recognized hallmark of the current state of social and economic activities. According to the definition of Schumpeter (made at the first half of the XX century [2], innovation is derived from combination of different existing production determinants and market factors. Unlike to that, the modern innovative technologies are primarily built on new fundamental theoretical and technological knowledge. Countries that use the latest technology are world leaders and according to various sources, scientific and technological development in these countries contribute of between 60 to 85% to gross domestic product (GDP) [20]. These technologies are: biotechnology, aerospace, nanotechnology, new materials and molecular optoelectronics, artificial intelligence, microsystem mechanics, photonics, software and simulation systems, personnel management and so on. The majority of experts defined the state of innovation in Ukraine as a crisis and such one does not correspond to the current level of innovation in highly developed countries. For instance, according to State Statistics Service of Ukraine only 17.3% of industrial enterprises implemented innovations in 2015 [21]. It probably determines the low competitiveness of Ukraine on the global market. According to the report of the World Forum Global Competitiveness in 2008-2009, Ukraine was 72nd among 134 countries [22]. Containment of innovative development in Ukraine is associated with the lack of financial resources, the decline in the demand for scientific and industrial products from the governmental and business authorities, the decreased quality of scientific personnel and reduced technological base of research [22].

Formation of information society in the modern world additionally contributes to the extremely high rate and the unbalanced development of social and economic processes. There is a controversy in the literature related to the definition of this term [23] – [27]. In the current study, we use term "information society" as the theoretical concept of post-industrial society development in which information and knowledge are produced in a unified information process. Main features of theoretical information society are [25]:

- The widespread increase in the role of information and knowledge in the life of society;
- The increased role of information technology in social and economic relations;
- Increase in the number of people employed in information technology field, communications and generation of information products and services and increase their contribution into country's GDP;
- Formation of information business culture [24] aimed to make a profit (surplus in value of information) from the production and distribution of information products and Internet-related technologies in all sectors of society;
- The creation of a global information environment that provides efficient interaction between people and their access to global information resources and meet their needs for information products and services.

It is widely accepted [25] that creation, distribution, use, analysis and manipulation of information are the major part of the economic, political and cultural activities of information society. Economy of Knowledge (or Information Economy) reflects such an economic activity, since the welfare of society is created through the exploration of knowledge or via understanding of nature of things and processes. The meaning of work itself is undergo the essential transformation because of that. Work overcomes to be just the utilitarian labor and become the creative activity with reduced motivation by financial factors [26].

Business activity is also acquiring new forms due to novel trends in the economy. First, we should note that there is combination of profit-focused and creativity-driven principles in the business under current conditions [1] unlike to industrial society, when this unity was lost. The creation and further development of the Internet is one of the most prominent features of modern innovative activities which were developed due to advances of information technologies. Technologies and formats for data transmission over the Internet have created the unique environment for the exchange of commercial information, conducting various types of electronic business (Internet-shops, after sale Internet services, on-line information services, mobile payments, etc. [28]. Most importantly, the formation of a global information environment highly accelerated globalization of all components of social and economic development of civilization, including its penultimate component - economic globalization.

Economic globalization is a complex and multifaceted process of a natural qualitative transformation of the world economy involving individual small businesses and also nation-wide economies. This transition based on the integration of production and the accelerating of the synergy process due to exceptional growth and enhancement of the international movement of goods, services, capital, human resources, extensive development of new information technologies, global telecommunication networks, standardization, legislation, etc. [29]. Globalization was induced by extensive scientific and technological development of society and nowadays globalization determines the formation and development of an open society, including formation of open economic systems from the micro- to the macro- levels. Globalization results in the novel configuration of the world economy. Multinational corporations, international organizations (IMF, World Bank, ILO, and WTO) and other now become the predominant players in the global economic process. Globalization enhanced the mutual interference and dependence of the world economy as well as the formation of strong, complex, and non-linear positive (or negative) direct and feedback mechanisms between economic systems and subsystems. Factors that could not significantly affect certain processes in the past, now getting more power because of mutual interference of world economies. Therefore, there is increase in the number of factors affecting the behavior of economic entities and their sensitivity to the internal and external disturbances of any nature. It raises the possibility of process development through multiple scenarios. For example, Korean TV channel reported falsified information in April 2003 that Bill Gates was killed referring to an alleged site of CNN. Such information would not have any serious effect on the market in the absence of globalization. However, this information was immediately shared via informational network in a modern globalized world and South Korean stock market dropped down for 1.5 percent. A total loss from this "joke" in according to experts was more than 3 billion US dollars [30].

Thus, as we stated above, current trends of scientific and technological development, information society and globalization cause the non-linear dynamical, open and unbalanced behaviour of social and economic processes in the world. It was postulated by the theory of the dynamics of complex systems [5] that under evolution of non-linear system, the non-linear feedback mechanism may induce self-influence and self-enhancement (or self-suppression depending on the nature of these relationships) of processes in such systems (environments). These non-linear positive (or negative) feedbacks are not necessary involved in the energy exchange but they are selective and they could determine configuration of process. If such non-linear feedbacks are organized topologically, their synergistic effect leads to a significant enhancement (or weakening) of the resulting process.

To our opinion, the dialectic of the current level of the evolution of civilization suggests that the non-linear dynamic behaviour of social and economic environment in the world would yield to two major outcomes. On the one hand, the mutual synergistic effect of scientific and technological development and formation of information society and globalization leads to a very sharp progress of all components of social and economic development, including enhancement of the science and technology itself, raising of globalization and developing of information society.

On the other hand, such synergy causes an extremely high level of volatility and unpredictability of the financial and economic markets, unexpected jumps, unexplained changes in economic trends, and sudden falls of production, severe financial and economic crisis. This ultimately induces a sharp increase in uncertainty, variability and unstable behavior of the market environment and increase in risk of entrepreneurship. Moreover, bifurcation behavior of modern economy implies [17] that the financial and economic activity of any enterprise has to be performed under conditions of the inevitable uncertainty and risk. This indicates the increased role and importance of business in the current economic conditions and justifies the raise in responsibility of business personnel for their performance.

Thus, the results of our research demonstrate that the concept of dying business functions under current conditions of the scientific and technological development is not correct. However, several economists support this idea. For example, Schumpeter believes that the trends of scientific and technological development formed in the 40-ies of XX century are still the same (Schumpeter, 2007). He considers the further economy development via two opposite scenarios. First, methods of production and goods themselves reach the highest level of perfection and needs of humanity are fully met. It eliminates the motivation for further technological improvements, and also the most of technological improvements become impossible because of the exhaustion of technological opportunities. As a result of the entrepreneurial activity dies. The second scenario (according to [2]) assumes that further industrial development will be governed by a team of highly qualified professionals. These subjects will create goods which required to work in highly predictable manner resulted of precise calculations. Schumpeter is one of

the founders of the economic theory of evolutionism [1]. Nevertheless, to our opinion, the limitation of his approach is that the process of evolution based on relatively slow (linear) changes and these changes take place in the closed systems.

**Conclusion and recommendations for further research.** Thus, our analysis demonstrated that non-linear, non-equilibrium and bifurcation nature of the micro- and macroeconomic processes in modern globalized (open) world leads to the manifestation of two trends. On the one hand, mutual resonance processes of scientific and technological progress and formation of information society and globalization is responsible for very sharp progress of all components of social and economic development, including accelerating of the processes of the science and technology itself, raising of globalization and developing of information society. On the other hand, this response causes a manifestation of extremely high sensitivity, volatility and unpredictability of the financial and economic markets, unexpected jumps, and sudden falls of production, severe financial and economic crisis. Such a sharp increase in uncertainty, unpredictability and variability of the business environment leads to formation of novel meaning and new content of the entrepreneurship in the present time.

This, in turn, causes the emergent need for developing a fundamentally new approaches, methods and models to describe the business activities and to meet the current level of social and economic development of society.

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#### ABSTRACT

Danchuk V.D., Kozak L.S., Danchuk M.V. Business activity in the conditions of nonlinear dynamic for social and economic development of society. Visnyk National Transport University. Series «Economic sciences». Scientific and Technical Collection. – Kyiv: National Transport University, 2016. – Issue 3 (36).

In paper the main factors, properties and trends of nonlinear dynamic of the social and economic development are identified and theoretically proved, and their impact on the business in the present conditions of economic processes are analyzed.

The object of study – the social and economic development processes of society.

Purpose – definition of the main factors, properties and trends of the nonlinear development of society and their impact on the business in the present conditions of economic processes on the base of systematic analysis.

Research methods – nonlinear dynamics methods of complex systems analysis.

The main determinants, properties and trends of non-linear nature of the economy development are identified and theoretically proven under the settings of the system analysis. These factors are derived from the synergistic interaction between a process of accelerating of scientific and technological development, and globalization of all components of the social and economic development. A sharp increase in the level of uncertainty and risk, volatility and unstable behavior of the market environment establish the increased role



of business in the modern economy. This concept was theoretically justified on the basis of the research. The proposed approach will further extend the understanding of the content, concept and function of business activity under conditions of non-linear dynamic nature of economic processes.

**KEYWORDS:** BUSINESS ACTIVITY, SYSTEM ANALYSIS, NONLINEAR DYNAMICS, SCIENTIFIC AND TECHNOLOGICAL PROGRESS, THE INFORMATION SOCIETY, GLOBALIZATION.

#### **РЕФЕРАТ**

Данчук В.Д. Підприємницька діяльність в умовах нелінійної динаміки соціально-економічного розвитку суспільства/ В.Д. Данчук, Л.С.Козак, М.В.Данчук // Вісник Національного транспортного університету. Серія «Економічні науки». Науково-технічний збірник. – К. : НТУ, 2016. – Вип. 3 (36).

В роботі виявлені та теоретично обґрунтовані основні чинники, властивості та тенденції нелінійно динамічного характеру соціально-економічного розвитку суспільства та проаналізовано їх вплив на підприємницьку діяльність в сучасних умовах перебігу економічних процесів.

Об'єкт дослідження – соціально-економічні процеси розвитку суспільства.

Мета роботи – на основі системного аналізу виявлення основних чинників, властивостей та тенденцій нелінійного характеру розвитку суспільства та їх впливу на підприємницьку діяльність в сучасних умовах перебігу економічних процесів.

Методи дослідження – методи аналізу нелінійної динаміки складних систем.

В рамках системного аналізу виявлені та теоретично обґрунтовані основні чинники, властивості та тенденції нелінійно динамічного характеру розвитку економіки, що пов'язані із проявом та резонансною взаємодією між собою процесів прискорення науково-технічного прогресу, повсюдної інформатизації, глобалізації всіх компонентів соціально-економічного розвитку суспільства. На підставі проведених досліджень теоретично обґрунтовано підвищення ролі підприємницької діяльності в сучасних умовах функціонування економіки, яка характеризується різким збільшенням рівня невизначеності та ризику, мінливості та нестійкості поведінки ринкового середовища. Використання запропонованих підходів дозволить у подальшому розвинути уявлення про зміст, концепцію, функції підприємницької діяльності в умовах нелінійно динамічного характеру перебігу економічних процесів.

**КЛЮЧОВІ СЛОВА:** ПІДПРИЄМНИЦЬКА ДІЯЛЬНІСТЬ, НЕЛІНІЙНА ДИНАМІКА, НАУКОВО-ТЕХНІЧНИЙ ПРОГРЕС, ІНФОРМАЦІЙНЕ СУСПІЛЬСТВО, ГЛОБАЛІЗАЦІЯ.

#### **РЕФЕРАТ**

Данчук В.Д. Предпринимательская деятельность в условиях нелинейного характера социально-экономического развития общества / В.Д. Данчук, Л.С. Козак, М.В. Данчук // Вестник Национального транспортного университета. Серия «Экономические науки». Научно-технический сборник. – К. : НТУ, 2016. – Вып. 3 (36).

В работе выявлены и теоретически обоснованы основные факторы, свойства и тенденции нелинейно динамического характера социально-экономического развития общества и проанализировано их влияние на предпринимательскую деятельность в современных условиях протекания экономических процессов.

Объект исследования – социально-экономические процессы развития общества.

Цель работы – на основе системного анализа определение основных факторов, свойств и тенденций нелинейного характера развития общества и их влияния на предпринимательскую деятельность в современных условиях протекания экономических процессов.

Методы исследования – методы анализа нелинейной динамики сложных систем.

В рамках системного анализа выявлены и теоретически обоснованы основные факторы, свойства и тенденции нелинейно динамического характера развития экономики, обусловленных проявлением и резонансным взаимодействием между собой процессов ускорения научно-технического прогресса, повсеместной информатизации, глобализации всех компонентов социально-экономического развития общества. На основании проведенных исследований теоретически обосновано повышение роли предпринимательской деятельности в современных условиях функционирования экономики, которая характеризуется резким увеличением уровня неопределенности и риска, изменчивости и неустойчивости поведения рыночной среды. Использование предложенных подходов позволит в дальнейшем развить представление о

содержании, концепции, функциях предпринимательской деятельности в условиях нелинейно динамического характера протекания экономических процессов.

**КЛЮЧЕВЫЕ СЛОВА:** ПРЕДПРИНИМАТЕЛЬСКАЯ ДЕЯТЕЛЬНОСТЬ, НЕЛИНЕЙНАЯ ДИНАМИКА, НАУЧНО-ТЕХНИЧЕСКИЙ ПРОГРЕСС, ИНФОРМАЦИОННОЕ ОБЩЕСТВО, ГЛОБАЛИЗАЦИЯ.

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