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BASIC ANALYSIS OF INDUSTRIAL ENTERPRISES SUSTAINABLE DEVELOPMENT SIMULATION

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АНАЛИЗ ПОДХОДОВ К МОДЕЛИРОВАНИЮ ПРОЦЕССА УСТОЙЧИВОГО РАЗВИТИЯ ПРОМЫШЛЕННЫХ ПРЕДПРИЯТИЙ

Current methodology of industrial enterprises sustainable development is analyzed. Sustainable development simulation models are divided into those related to internal and external environment of an enterprise and also those been designed by means of different mathematical instruments. A range of tasks performed due to current methodology is highlighted. Problems unsolved before are revieled and given ways of solving to enable industrial enterprises to develop sustainably.

Проанализированы существующие подходы к разработке методических основ процесса устойчивого развития промышленных предприятий. Обоснована группировка существующих моделей устойчивого развития по признаку внешнего и внутреннего устойчивого развития предприятия, а также по признаку инструментария, используемого для построения моделей. Выделен ряд задач, решаемых при помощи разработанных методических основ по обеспечению устойчивого развития предприятия. Выявлены не решенные задачи и на этой основе предложены направления усовершенствования методических основ обеспечения устойчивого развития промышленного предприятия.

Ключевые слова: устойчивое развитие, промышленное предприятие, моделирование, управление

Keywords: sustainable development, industrial enterprise, simulation, control.

Introduction. Being a globally recognized paradigm of humanity progress sustainable development phenomenon has converted from a goal to a major modern challenge for all countries and individuals. Especially it becomes dramatic for the least developed countries which are the place of spanning such important hazards as food deficit, lack of drinking water, climate disasters, poverty and others. Under these conditions the need of designing special economic vertical containing different instruments for providing sustainable development arises. It is related to decision making on the highest and the lowest level of economy. One of the most obvious facts is enabling industrial enterprises to be developed sustainably and contribute to the overall sustainable development. Firstly it must concern mining enterprises or those deeply integrated into environment with ecological and societal impacts that generate negative effect because unlimited using of natural resources and producing non-renewable energy resources do not allow saving nature for future generations. Also unfortunate polarizing between energy production negative impact and humanity energy requirements has encesred over past decades. Though, the issue of industrial enterprises sustainable development simulation in order to provide further correct decision making with true data of all their operations must be addressed.

A lot of research works followed by important and realistic theoretical and practical results are worth pointing out. Although there are many different papres dedicated to sustainable development in a global scope and also for countries, towns and regions it is of crucial importance to consider scientific outcomes of Ukrainian researchers. It could be explained by the next peculiarity. Almost 33% of Ukraine territory which is about 634 thousand square kilometers of land is occupied by mining industry [1, p.60]. This territory has been developed unsustainably yet. So a large-scale problem of industrial enterprises sustainable development in Ukraine causes a special attention to research works of Ukrainian scientists. Among them are such famous researches as V. Geets, A. Amosha, O. Novikiva, I. Petenko, V. Burkinsky, M. Zgurovsky and others. Taking into consideration their scientific results which undoubtedly enriched scientific bases for fostering sustainable development some unsolved problems should be pointed out.

In particular for improving current methodology of sustainable development simulation existing models should be revised and classified. It will allow finding their limitations led to unperformed tasks of sustainable development out and make positive improvements. Also some models conceptual bases do not condition sustainable development in globally recognized manner as harmony beetwen economics, nature and society. Very often one or two of them become more important in a model breaking the sense of sustainability.

Research goal and tasks. The general goal of conducted research is to analyze current methodology of industrial enterprises sustainable development, find out principals of enterprise sustainable development models division, highlight a range of tasks performed due to current methodology and reviel problems unsolved before with showing ways of their overcoming.

General methods of scientific investigation have been used for achieving the goal set above. They are analyzing, generalizing, building logic chain, critical thinking, clustering by general features and analyzing distinguishing features.

Results. On the bases of proper analysis of many scientific research works a hypothesis has been made. It has been suggested that current methodology for sustainable development of exactly enterprises if sustainable development is presented as balanced interaction of not only economic and nature components but also economic, nature and social ones focused on internal and external enterprise environment should be improved for providing managers with actual instruments of decision making. Generally methodology of making development sustainable is focused on global, national and regional economies as such investigation are supplied with a large statistical database containing all indicators of economic, natural and social development. In turn such indicators representing enterprises activities are variable strongly for different branches of economy and difficult to collect. But some authors [2, p. 67; 3-4] avoid any numerical estimates using structural graphic models for visualization of sustainable development. Often sustainable development of an enterprise is identified with just stable functioning and its methodology comprises different models of new financial rates, capitalization and general financial stability. All this leads to mining enterprises not being supplied with modern instruments of control of their production operations for achieving sustainability as a concept of harmonious economic, natural and social interaction.

Today scientists use different methods of formalization of enterprise sustainable development holding special discussions about what method is more suitable for control

an enterprise in practice. However, the choice of the mathematical modeling method or approach to graphical visualization influences the area of enterprise functioning and its development, as well as managers' ability to predict further development trend in the short and long term to confirm optimal solutions [5, p. 254]. Other words basic set of parameters of enterprise sustainable development affects unique "impact points" of its three-dimensional social, ecological and economic system in order to not only achieve a state of social, environmental and economic sustainability at a certain time, but also save it during transition of the whole system to a qualitatively new level of performance associated with, for example, the discovery of new mineral deposits, changes in the organizational structure of the enterprise, changes type of property and entry into holdings, changes in internal technological and economic factors due to innovation, etc., which is sustainable development.

Therefore finding principal approaches to mining enterprise sustainable development is an important task for research. Its performing will reveal new ways and means of increasing enterprise production efficiency adhering principals of sustainable development, allow establishing new structural and functional interconnections between different factors and redesigning qualitative set of enterprise efficiency indicators and their numeric values.

For accomplishing the task highlighted above current approaches to sustainable development modeling including special simulations for enterprises sustainable development will be analyzed. Also analysis will cover models of sustainable development of countries, regions and towns. It will support deeper understanding of sustainable development itself and combine factors of macro and microeconomy during it as notion of how national and regional sustainable development is estimated is helpful for evaluation each enterprise contribution to this complex process. Also such analysis will be useful for extracting advantages and disadvantages of existing sustainable development models under conditions of mining enterprise, finding approaches for methodology improving to enable mining enterprises to develop sustainably.

Current sustainable development models which have appropriate concept platform and can be modified and used for mining enterprises under certain conditions could be divided into three main types: graphical, mathematical and combined. This article is covering just the first type. Although there are many sustainable development models most of them are theoretical and cannot provide mining enterprise with appropriate methodology for control.

Against the background of achieving social and environmental balance factors of increasing enterprise economic efficiency visualized by means of graphical models are based on researchers' imaginations of sustainable development structure elements and their interconnections with other elements of other systems. As a rule such models are easy taken by managers, suitable for practical use, allow understanding internal and external enterprise environment and are able to be a basis for designing control system in enterprise sustainable development. However modern economic space described by stream information flows, ecological hazards and social unsafety requires decision making of city-forming mining enterprises managers to be quantitatively estimated, clear and certain, fast and taking into account all risks. In this case such decisions will be evaluated as optimal or rational. Unfortunately graphical models will not supply managers with instruments described by criteria highlighted above.

Mathematical models of mining enterprises sustainable development providing calculations of certain indicators of their economic, social and ecological processes, perspective trends and optimization of operations in external environment do not allow viewing enterprise systematically, analysis structure and logic of sustainable development in internal and external environment.

Some graphical modes of enterprise sustainable development ensuring should be presented and analyzed.

Classical graphical mode of sustainable development ensuring which can be interpreted for mining industry is represented in Barbier's model "Triple Bottom Line" [6, p. 108], designed in 1987 and based on Venn diagram showing all possible logical relations between finite selection sets (Fig.1). This model is criticized for its low level of practical use as there are no factors which are included into central triangle of sustainability and influence this triangle's borders [7]. Under given research this remark is transformed into a task of selecting a set of indicators located in the triangle of sustainable harmony.

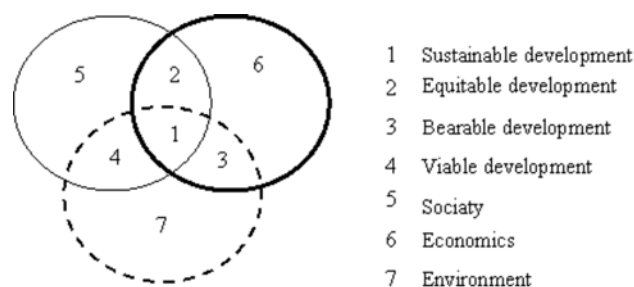


Fig. 1. "Triple Bottom Line" model of sustainable development, Barbier

Exactly on the basis of classical graphical sustainable development model an interpreted model for enterprise sustainable development was offered by Grason D., Lemon M. [8, p.17] (Fig.2). Enterprise sustainable development here is to some extent changed to innovation process followed by creating of value added. Precisely creating of value added in society, economics and environment is seen by authors as enterprise sustainable development. Though the model have some aspects could be discussed. For example, enterprise strategic development ensuring due to only its balanced interaction with society as it is offered in the model is quite difficult.

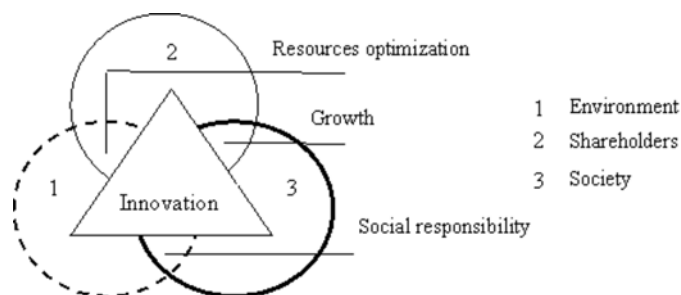


Fig. 2. Enterprise sustainable development by Grason D., Lemon M.

Guitt G. model "Egg" [9, p.27] represents hypothesis of sustainable development being an interaction of only two elements – society and nature (Fig.3). Although economics is hidden in the model it is not appropriate mode for enterprise if it is considered generally as factors of production combination unlike modern stakeholders' theory.

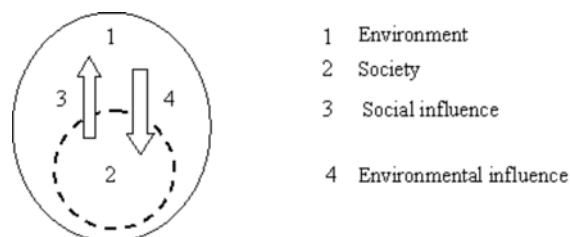


Fig. 3. Sustainable development "Egg"-model by Guitt G.

Along with system representing of sustainable development by means of graphical models authors do not explain what kinds of indicators should be taken for enterprise sustainable development ensuring.

Conclusion. The article represents analysis of current methodology of industrial enterprises sustainable development performed for the purpose of highlighting modern trends in sustainable development. Due to generalizing and making logic chain sustainable development simulation models are divided into those related to internal and external environment of an enterprise and also those been designed by means of different mathematical instruments. Models of enterprise internal sustainable development are aimed at providing internal factors control in order enterprise to be integrated into society and environment. In turn models of enterprise external sustainable development allow evaluating of its performance in accordance with environmental and social sustainable development. A range of tasks performed due to current methodology is highlighted. They are aimed at evaluation sustainable development rates of enterprise. Problems unsolved before are revealed and given ways of solving to enable industrial enterprises to be developed sustainably.

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