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PLANNING OF STEADY INDUSTRIAL ENTERPRISE DEVELOPMENT UNDER CONDITION OF ENVIRONMENT INSTABILITY

Raising of problem. In the conditions of globalization of the world economy an important role is played by industrial enterprises. However existent priorities of development and functioning of enterprises often fall behind the requirements of modern society.

Forming of the modern economic system of Ukraine took place mainly in accordance with exogenous model, essence and the outline of which were stipulated by the development of the export oriented enterprises, fuel, energy and metallurgical complexes. Unfortunately, export expansion of these industries was not accompanied by a technological breakthrough, the production remained expensive, based on the use of cheap power sources and labour. The situation became urgent under the condition of economic crisis, and rapid fall in demand for products. Therefore for stabilizing and increase of level of competitiveness of economy of country urgent steps in the strategy of enterprises development of all industries are needed for entering the world market, in particular on the basis of the effective planning of their activities and development.

Analysis of the recent research works. The general approach to planning of enterprise activities is expounded in works of foreign and home authors : A. Henderson, W.Cooper, R.Dorfman, J. von Neiman, J.Riggs, P.Samuelson, A.Charns, I.Aramonov, A.Bakhtin, I.Bohomolov, N.Herasimov, Y.Kisliakov, W.Lihtenstein, F. Miszoakhmedov, B.Orazbaev, V.Zviagina, V.Surina, R.Tkachenko, O.Tsarkova, V.Chistiakova etc.

Primary most works of authors that engaged in the problems of development of plans of enterprise activities are based either on the experience and statistical or normative methods of plan drafting that under the condition of unstable environment can result in their inadequacy. As I.Prigozhin stated [1], "... it should be remembered that, although we in principle can know the initial conditions in the endless number of points, the future, nevertheless, remains unforeseeable fundamentally ". Therefore the problem of fundamental search of alternative methods of planning under the conditions of instability is actual, and is often touched upon in scientific literature [2-3]; the mechanism of planning of steady industrial enterprise development requires a further study and perfection in the context of Ukraine becoming a competitive participant of the world trade.

The aim of this article is description of conceptual model of planning of steady industrial enterprise development under the conditions of environment instability.

Exposition of basic material. In the conditions of environment instability, the primary objective of any enterprise is not to cease to exist, and to form pre-conditions for the further perspective profitable functioning. The main task of the modern stage of economy development is revival of industrial production and economy on the whole.

Steady development of the producing and economical system is investigation and description of quality of decisions made. The mechanism of providing stability of enterprise must be realized, foremost, by means of strategy forming of steady enterprise development. Steady development of enterprise is provided by the permanent increase of production of goods, and growth of the volume of sales. The permanent growth of sales is mediated by the growth of income of enterprise [2-3].However, the increase of production and sales volumes must be accompanied by the growth of efficiency indexes of the use of all resources of enterprise.

Planning envisages the development of aims and complex of measures, stipulating the sequence of results achievement taking into account the possibilities of the most effective use of resources by every productive subdivision and organization in general. According to aforesaid it is possible to draw the conclusion that planning is a well-organized process based on treatment of information for the development of project in certain parameters for the achievement of definite aims in the future. We understand under the term of the instrument of planning a set of resources, methods, approaches the enterprise will be able of using for planning the activity, defining prospects and possibilities of the organization in the achievement of the desired results.

The task of steady development of industrial enterprise planning consists in planning of such influence of management (management of enterprise) object on subject of management (subsystems of enterprise) where the greatest amount of the aims set is achieved.

We will describe the conceptual model of steady development of industrial enterprise planning that, unlike other approaches, is based on the stage-by-stage design of planning process of enterprise activities providing quality transformation of enterprise as a difficult

system and allowing it to define the effective trajectory of steady development (see Fig. 1).

Prognostication of basic economic indicators (for example, incomes, finding). An enterprise is a complex dynamic system with changes of its parameters in accordance with factors of environment. The smooth change of parameters will be described as a "step" ("sigmoid") function, playback of the transition of size from one level to other. For measuring the parameters of

"smooth transition" it is suggested to use the sigmoid function of Boltzmann:

$$F(t) = A_1 + \frac{A_2 - A_1}{1 + e^{\frac{t - t_0}{\tau}}}, \qquad (1)$$

where A1 and A2 are values of economic indicator of F before and after process; t0 is a moment of time, in that a process takes place most intensively; τ it is a parameter stipulating transition duration.

PLANNING OF STEADY ENTERPRISE DEVELOPMENT

Aim:
Increase of enterprise management efficiency due to development and application of mechanism of planning of its steady development under the conditions of environment instability

Steady Enterprise Planning

Evaluation of Economic Stability

Prognostication of Basic Economic Inidcators (Income, Funding)

Evaluation of the Stability Class

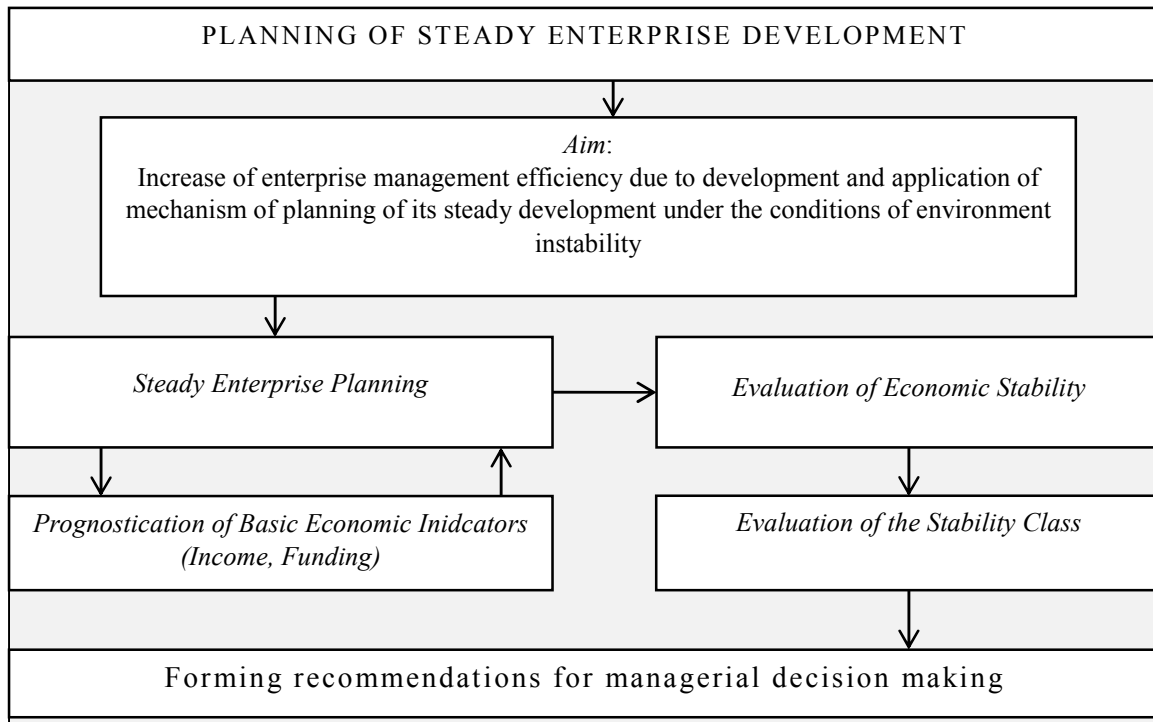Forming recommendations for managerial decision making

Fig. 1. Conceptual model of planning of industrial enterprise development

At the same time plenty of processes of different character, beginning in different moments of time and resulting in different economic indicators certain increase takes place on an industrial enterprise. Therefore the real dependence of F (t) can be considered imposition of great number of separate transitions. In this case dependence of F (t) it is expedient to present as a sum (superposition) of a few sigmoid functions (multisigmoid presentation). In case of arbitrary amount of sigmoid elements a formula for F (t) is written down in a kind [4]:

$$F(t) = A_1 + \sum_{i=1}^{N_S} \frac{A_{i+1} - A_i}{1 + \exp\left(\frac{6t - 3(t_{нi} + t_{кi})}{\Delta t_i}\right)}, \qquad (2)$$

where $(A_i - A_{i+1})$ – increase of economic indicator F in the process of i- go of transition; $t_{нi}$, $t_{кi}$ и Δt_i – ime of beginning, completions and duration of i- go of transient. Use of constant 3 it is possible to ground that at

moving away from t_0 na 3τ the sigmoid function of Boltzmann practically fully goes out on a horizontal asymptote (an exact calculation shows that on 95,26 %).

From the mathematical point of view determination of parameters of multisigmoid for a concrete index after Nr of preceding years behaves to the tasks of class of approximation. It is necessary on the known set of points (ti, Fi) to pick up analytical expression of F (t), that will be maximally near to this set of points, and accordingly in the best measure will describe the present set of statistical data. In this case the set of points (ti, Fi) are data of accounting control, and analytical expression is searched as superpozition a few sigmoid F (t). Determination of parameters sigmoid function it is possible, for example, to produce the least-squares method (of MNK) [3, 5].

Example, prognostications of sizes of income and funding on the basis of approximation presented the sigmoid functions of Boltzmann on fig.2.
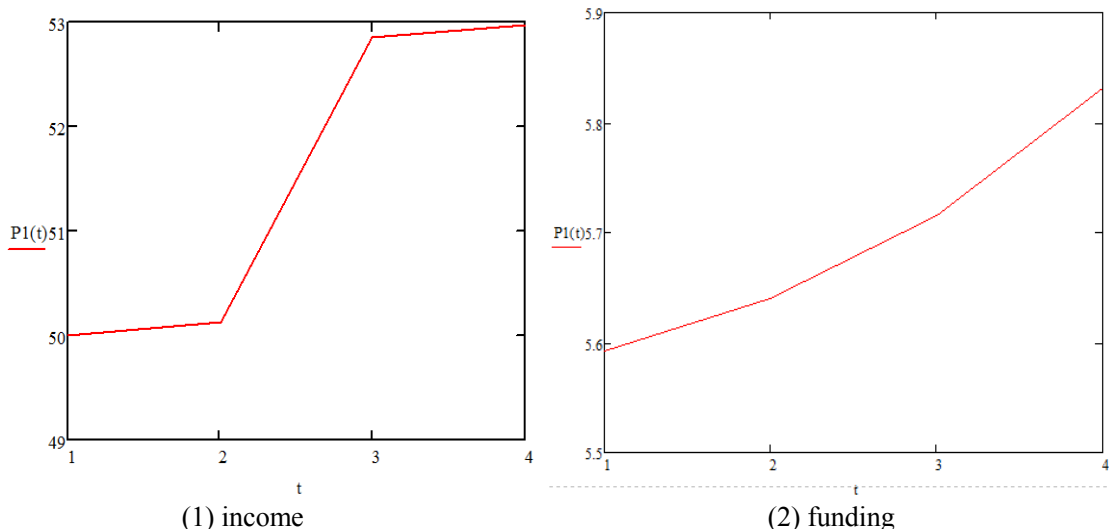
(1) income   (2) funding

Fig. 2. Charts of sigmoid function of Boltzmann

Defining the trajectory of development of enterprise thus, further logically to estimate stability of this trajectory.

Carrying out the activity in a market environment, an enterprise will realize a progress trend is this acquisition of new quality, qualificatory stability of vital functions of organization, her height, that is inalienable part of planning.

Stability of industrial enterprise is a steady-state of enterprise in certain moment of time, characterizing the quality and effective indexes of business processes, and also ability of enterprise to save these indexes under act of constantly changing environment.

The estimation of economic stability it is suggested to execute according to a next algorithm [6-7]:

- forming of the informative field (collection of information);

- choice of standard index;

- statistical processing of data;

- setting of norms of data;

- analysis of connections between a standard index and criteria of economic stability;

- selection of coefficients of ponderability for the selected criteria of economic stability;

- construction of integral coefficient of economic stability of the system;

- estimation of level of economic stability of enterprise;

- determination of class of economic stability.

The integral coefficient of economic stability of the system we will present as a functional order taking into account gravimetric coefficients [6]:

$$ES = \sum_{p=1}^{h} w_p \cdot F_p - \sum_{u=1}^{m} w_u \cdot F_u, \qquad (3)$$

where F_p, F_u – functional criteria of the positive (stimulant) and negative (anti stimulant) affecting economic

stability accordingly; w_p, w_u – specific gravity of meaningfulness of indexes F_p, F_u; h, m– amount of indexes positive (stimulant) and negative (anti stimulant) affecting economic stability of the system (enterprises) accordingly.

Gravimetric coefficients are determined as follows:

$$w_{i,j} = \frac{2 \cdot \sum_{p=1}^{j} \sum_{l=1}^{n} d_j}{\sum_{l=1}^{n} d_j \cdot \sum_{p=1}^{j} \frac{2 \cdot \sum_{p=1}^{j} \sum_{l=1}^{n} d_j}{\sum_{l=1}^{n} d_j}}, \qquad (4)$$

where n – amount of periods chosen for an analysis; p – amount of the selected indexes. For determination of parameter d_j in scientific literature [6] it is suggested to use weighing methodology that is base on comparison of chain indexes of the selected indexes F_{it}/F_{it-1}, with the chain index of standard index E_t/E_{t-1} on the basis of calculations of square root from the square of difference between them:

$$d_j = \sqrt{\left(\frac{E_t}{E_{t-1}} - \frac{F_{it}}{F_{it-1}}\right)^2} \qquad (5)$$

Further on the value of integral index of stability the class of stability is determined. In a table 1 description of classes of stability is presented for an integral index ES.

In a table 2 presented to recommendation on planning of steady development of enterprise depending on the class of stability, that was certain before.

Table 1

Value of index ES and description of stability

Class of stability	Value of index	Description
Absolute steady development	$0,9 < ES \leq 1$	Economic position high-efficiency. A personnel is provided with a stable salary, the optimal terms of his labour, rest are created. Implementation does not cause a doubt the enterprise of all obligations.
High steady development	$0,8 < ES \leq 0,9$	Characterized by the stable increase of technic-economic indexes within the limits of the pre-arranged values. The level of social material well-being of workers is high with the prospects of further development. The all-round analysis of activity of enterprise shows high probability of implementation to them all contractual obligations.
Normal steady development	$0,7 < ES \leq 0,8$	Characterized by the even positive trend of indexes, but values of the below planned sizes. The analysis of activity of enterprise shows acceptable probability of implementation to them all basic obligations.
AV steady development	$0,6 < ES \leq 0,7$	Economic position is provided by stable technic-economic indexes. An enterprise can have some difficulties with implementation of contractual obligations.
Low steady development	$0,5 < ES \leq 0,6$	The economic state is described by substantial gallops in characterized his indexes. An enterprise can have certain difficulties with implementation of contractual obligations.
Unsteady development	$0,4 < ES \leq 0,5$	The basic elements of component support the values of indexes up-to-the-mark. Social security of personnel is not provided. An enterprise is constantly subject to the danger of derangement or worsening of implementation of the obligations.
Critical position	$0,3 < ES \leq 0,4$	Greater part of indexes is at low level, there are problems in a production or production distribution. There were difficulties, but implementation of basic obligations is yet possible.
Crisis position	$ES < 0,3$	Characterized by failures in industrial and economic activity, producing of products is conducted irregularly, before produced production distribution does not come true. An enterprise is not able independently to execute contractual obligations.

Table 2

Recommendation

Value of index ES	Recommendation on planning of steady development of enterprise
[1-0,8]	continuation of functioning of enterprise on drawn up a plan; increase of values of plan technic-economic indexes with the purpose of achievement of new aims.
[0,8-0,6]	restructuring of enterprise, with the selection of profitable productive subdivisions; maintenance of the folded economic connections with partners; search of new partners for a collaboration.
[0,6-0,4]	decline of unit cost; reorganization of corresponding components or control system by an enterprise on the whole; perfection of pricing on the produced products (to bring down prices on commodities, to attract customers); analysis of profitability of products (to give mind on the production of more cost-effective goods).
<0,4	participating of enterprise is in the different investment and innovative programs, that gives an opportunity of the use of privileges on taxation and crediting; bringing in of new investors; taking of inventory of supplies and equipment with the purpose of exposure of surpluses for realization on market prices with the purpose of receipt of additional financial resources.

Conclusions

The use of the offered scheduling of development algorithm will allow to guidance to estimate stability of economic position of enterprise and rationally to dispose of the resources for the effective functioning in future. The method of multisigmoid approximation besides possibility of analysis of aleak economic processes allows with the high degree of reliability to forecast the set economic indicator on the nearest periods. The method of estimation of economic stability will allow to identify the level of stability on the basis of prognosis values. Application of the offered complex model an enterprise will allow to correct the business processes and provide the stable functioning in the future.

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Набережних Т. С., Шевченко Н. Ю. Планування сталого розвитку промислового підприємства в умовах нестабільності зовнішнього середовища

Обговорюється проблема пошуку принципово інших методів планування діяльності й розвитку підприємства в умовах нестабільності зовнішнього середовища. Відмічено, що пропонований в науковій літературі механізм планування стійкого розвитку промислового підприємства вимагає подальшого вивчення і вдосконалення в контексті становлення України як конкурентоздатного учасника світової торгівлі. У статті описана концептуальна модель планування стійкого розвитку промислового підприємства, яка, на відміну від інших підходів, базується на поетапному моделюванні процесу планування діяльності підприємства, що забезпечує якісну трансформацію підприємства як складної системи і дозволяє визначити ефективну траєкторію його стійкого розвитку. Пропонується використовувати метод мультисигмоїдальної апроксимації для прогнозування основних економічних показників на найближчі періоди. На основі прогнозних значень пропонується формувати траєкторію розвитку підприємства та здійснювати оцінку стійкості обраної траєкторії.

Ключові слова: підприємство, планування, стійкий розвиток, моделювання, мультисигмоїдальні функції, економічна стійкість.

Набережных Т. С., Шевченко Н. Ю. Планирование устойчивого развития промышленного предприятия в условиях нестабильности внешней среды

Обсуждается проблема поиска принципиально иных методов планирования деятельности и развития предприятия в условиях нестабильности внешней среды. Отмечено, что предлагаемый в научной литературе механизм планирования устойчивого развития промышленного предприятия требует дальнейшего изучения и совершенствования в контексте становления Украины как конкурентоспособного участника мировой торговли. В статье описана усовершенствованная концептуальная модель планирования устойчивого развития промышленного предприятия, которая, в отличие от других подходов, базируется на поэтапном моделировании процесса планирования деятельности предприятия, обеспечивающего качественную трансформацию предприятия как сложной системы и позволяющего определить эффективную траекторию его устойчивого развития. Предлагается использовать метод мультисигмоидальной аппроксимации для прогнозирования основных экономических показателей на ближайшие периоды. На основе прогнозных значений предлагается формировать траекторию развития предприятия и проводить оценку устойчивости выбранной траектории.

Ключевые слова: предприятие, планирование, устойчивое развитие, моделирование, мультисигмоидальные функции, экономическая устойчивость.

Naberezhnyh T. S., Shevchenko N. Yu. Planning of Steady Industrial Enterprise Development under Condition of Environment Instability

The problem of search fundamentally of another methods of planning of activity and development of enterprise comes into question in the conditions of environment instability. It is marked that the mechanism of planning of steady development of industrial enterprise offered in scientific literature requires a further study and perfection in the context of becoming of Ukraine as a competitive participant of world trade. The improved conceptual model of planning of steady development of industrial enterprise is described in the article, that, unlike other approaches, is based on the stage-by-stage design of process of planning of activity of enterprise, providing quality transformation of enterprise as a difficult system and allowing to define the effective trajectory of his steady development. It is suggested to use the method of multisigmoid approximation for prognostication of basic economic indicators on the nearest periods. On the basis of prognosis values it is suggested to form the trajectory of development of enterprise and conduct the estimation of stability of the chosen trajectory.

Keywords: enterprise, planning, steady development, design, multisigmoid functions, economic stability.