

Evaluation of the adaptability of the output of machinery production system

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Abstract. The adaptability of the machinery production system is essential part of their competitive fight not only at regional, national but also at global level. Many marketing approaches, methods and indicators have been developed regarding this problem, but the inclusion of technical and economic parameters of the production still provides field for expression. In a series of three articles of which this is the final attempt to study, evaluation and selection of the additional methods and indicators, that can complement the evaluation of the adaptability. It is proposed final comprehensive method, based on benchmarking.

Index terms: adaptability of the machinery production systems, adaptability of production systems output, methods and indicators for evaluation of the adaptability.

I. INTRODUCTION

The most important task of the industrial enterprises in Bulgaria at present is to produce competitive products /services/ with advanced technologies, and modern equipment and the best methods for organization of the processes. The adaptation of the business to market conditions is a key problem of Bulgarian National Economy. In general the adaptation can be treated as a process of the adoption of production systems to the changing environmental conditions or to the internal changes in the systems, which leads to the increase of the effectiveness and the effectiveness of operation, through the skeptical prism Assessment of the Competitiveness. This article is the continuation of the presented (както го беше написала имаше съвсем друг смисъл) problems and ideas for their solving in the preceding articles: "Evaluation of the adaptability of the input of machine manufacturing systems" and "Evaluation of the adaptability of the main technology system of the machine production systems". With it we conditionally try to close this process of study of problems with suggestions for their solution. We have analyzed and synthesized ideas from theoretical developments, which may be useful to the specialists in the practice as we do not pretend for comprehensiveness and "panacea" for good practices.

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Management literature has long concentrated (especially under the influence of the developments of W. Porter) attention on the adapting process of the company from industrial environment through strategies for dealing with threats and opportunities associated with this environment. In the light of the turmoil and uncertainty which characterize modern behavior and functioning of the markets, it is focused on new modern approach to place leading practices of proactive strategies for foreseeing changes in the environment and their impact on the competitive game. According to us nothing new. According to W. Porter this problem for selection of adaptation strategies is based on the idea, that the adaptation is a process, difficult, expensive and Why? If there are no barriers for adaptation, all economic entities in specific sector gather information of fast progress towards implementation of optimal strategies in the light of indicators for characteristic of this environment. Imperfect adaptability of the economic enterprises is a drawback, but in another aspect is essential for keeping the diversity in the frames of the sectors and fields as one of engines of industry dynamics.

Adaptation is supported by two types of realization processes. The first, which is initiated by the management of the company, have to changes its behavior. It aims at a presumed dissonance between the results of the economic enterprise and its goals, defining opportunities for business: production, technological, marketing and social, which are not or are poorly used to identify changes in the environment and perform unsatisfactory role in accounting new threats and opportunities, observation of internal inconformity to the challenges. This type behavior includes the information system of the company and its agencies in the so-called "cognitive cards" for the interpretation of the signals and determination of their answers.

The second type of behavior is realized at strategies level for adaptation of the above mentioned and includes the adoption of new resources and new opportunities for the expansion of the economic system in terms of the field of management decisions for possible behavior.

These two processes of the behavior are impeded by many factors regarding the inertia of the management of organizational character, the complexity, and cognitive processes on the basic of the existence of irreversible



economic, technological, and marketing decisions. The research of the good practices and developed coping strategies include mobilization of notions so to take into account these processes, i. e. how to form and develop the whole range of possible behavior forms, so that the company to be able to perform adapting behavior and take into account the factors of inertia and dissonance. Blocking is probable, but it requires meeting the efforts of the management and accounting of the environment so to adapt. We present this study as analytical framework, based on the strategic management theory, the resources used and evolutionary approach to the aim of the economic system on the basis of the adaptation idea (Pralhad CK, (1999) and Prahalad SK, Hamel G. (1990)).

The criterions, strategic factors and the results that affect of the output of the production system in the machine manufacturing are various.

The criterions are related to the goals, set in the output of industrial enterprise. Their nature finds its expression in the specific indicators, set in the system of management objectives of the machine production system. The real value of these indicators is determined on the bases of the values achieved through realization of the general effectiveness and efficiency of the production. On the magnitude of specific indicators that assess the degree of achievement of management goals of the machine-building enterprise, influence the following main factors:

- the chosen methodology of system formulation of the management goals of the machine production system;
- the applied methodology of marketing research and rational strategic choice of market opportunities for the development of economic enterprise /right marketing strategy/;
- the real evaluation of the economic enterprise potential and its innovation ability.

From here output and the main methodological tools of strategic management of the machine production systems:

- right choice of economic enterprises of strategy and philosophy /mission, vision and goals/;
- right choice of approach for realization of the goals;
- selecting a form of business collaboration and cooperation of the economy enterprise;
- develop the potential and the innovation ability of the production system;
- develop a set of strategic goals;
- rational selection of market opportunities for development of the economy enterprise and formulation of adequate marketing strategy;
- achievement of adequate of the market marketing position.

However, the issues about construction of adaptive management tools of the economic enterprise have to be completed In particular, the problem is not been

completely solved for the management of economy enterprise with integrated information systems for management that enable flexible management of the action of the supply and the realization in terms of the logistics approach. Some aspects of the methodology for management and evaluation of the effectiveness and the efficiency of the adaptation process has not been developed enough.

II. CONTENT

The markets for engineering products and services become more dynamic and unpredictable. Tendencies such as shortening products life cycle, individualization of customer requirements, and globalization, which include adaptation to international markets and standards have been observed. As a result, demands for adaptable production systems are addressed to manufacturing engineering and economic indicators for evaluation and taking of economic decisions.

One of the most significant results in the evolution of free entrepreneurship in fact that favorable social environment for the development of free entrepreneurship is gradually turning from benevolent into hostile. As Peter Drucker noted, free entrepreneurship becomes a victim of its own success. In new realities the environment of the entrepreneurship redirect its attention from economic benefits that the entrepreneurship brings it to the drawbacks and negative impacts of its functioning and activity. And for this reason from “sacred cow” of economic progress the entrepreneurship turns into preferred object of controlling and audit. The result of occurred significant changes in the relationship entrepreneurship - socium is the tendency of the revision of the entrepreneurship role in new realities of the post-industrial era. Gradually the tendency of entrepreneurship is formed as a process of creating an abundance of benefits in the new condition to be placed in the services of global objectives. Tendency according to which the entrepreneurship turns from purely economic into socio-economic “institution”, which shifts the scientific rhetoric arises. Suppose that marketers in development market economies hardly notices or missed the rush of the strategic planning and strategic marketing than the formed conditions of business in Bulgaria additionally impede their ability to be noticed and applied in Bulgarian practice. This circumstance makes it necessary the attention to be focused on the anatomy of the strategic thinking (Marrison J., J. G. Lee) and to help through this to release the theory, practice and education of stereotypes of the past, thinking, beliefs and practice, typical for industrial age.

In the newly formed environment, manager rationalism is replaced with the systematic, functional and situational approaches in the management. Now the economic enterprise is considered an “open system”. And the main prerequisite for the success in its activity are sought not

only within the system, but also out in its surrounding. In the new challenge the success related with this how the system is able to adapt appropriate to its external environment – economic, political, social-demographic, environmental and technological.

When it is said that at the new paradigm of the place of the managerial rationalism comes the role of the adaptation, is not about “writing off” the rationalism, but about superstructure above the factor with higher role for the success of the business– flexible adjustment. Without the ability of the machinery system to adapt to changing business conditions, the rationalism loses meaning. On the other hand, the adaptation without rationalism also loses its meaning. So in this case it is about a specific plane of managerial rationalism, i. e. for its modernization.

Outside the limits of the economic system the industrial age managers are consistently forced to battle for market share. They are obliged to foresee most accurately the requirements of the customers; they were also obliged to observe the exact term of delivery, to determine prices according to competitive conditions. The managers were obliged to look after consistently and generally to maintain the reputation of the economic enterprise in the customers, users and investors.

Attitudes towards this transition is so, because the postindustrial age strongly and abruptly increases the uncertainty of the business environment, requires a new outlook on economic transactions, a new perspective on the participation, requires a new (creative) way of work and adaptation. Most of the economic units continue to focus its attention and energy on marketing, without noticing significant changes in the technologies, political conditions and other elements, which form the environment. They continue to rely on analogy with the past. But practice shows more explicitly that the past experience is no longer able to serve as a leadership for the future. New orientation, new knowledge, new approach to the reality is necessary. So, in the post-industrial era a significant increase in the changeability of conditions, in which flows the entrepreneurship activity passes, is available. This high and accelerating changeability makes the existence of the economic enterprise problematic, because it (changeability) “replaces” habitual world of marketing and production with awkward world of unfamiliar technologies, unexpected competitors, new desires and demands of consumers, new frameworks of social control (Manov V., (2004)).

The realities differentiated from issues /notes Peter Drucker/, on which politicians, economists, scientists, businessmen, union leaders still emphasize, for which books are still written and speeches are still delivered. The discrepancy with the reality, which characterizes a significant part of contemporary political and economic science, is a convincing proof for this (Manov V., (2004)). Other researches add that slogans, promises, problems of

yesterday, which still dominate in public speeches, still limit our views, are one of the biggest obstacles to achieve results (Keynes, JM 1993).

From all European programs this, which gives directly money to the business is the most palatable to control. Therefore it is kept quiet, but fierce battle for it. It is on many fields, it is led from certain circles in the management and is for the control over as many resources as it can. At present the project of the new Operational Program “Competitiveness and Innovation” is very simple, which has its pluses: gives more flexibility in the management, which so far has always been complicated and slow. In the name of this flexibility in contrast to the previous program now there is not a separate section, in which to provide absorption of money with financial tools. In the previous programming period this has represented a third of the money in the initiative JEREMIE – almost EU 350 million euro. The difference is that regarding the grants the decisions for the financial funds are made by administration, and it is under the control of the government. While regarding JEREMIE the decision is really exported outside of administration – it can provide strategic look at what financial instruments are structured, but their operational distribution of companies is a job of independent financial institutions. This means that financial products and pure subsidies do not compete, i. e. both are tools through which the public money from Europe are absorbed. Each of them is suitable and demanded variant depending on preferences of the companies. The important thing on which the European Commission insists on is a mix among them not the politicians to struck one – either from populism or ideology.

In theory there are different terms, used for concept, which is referred herein as adaptability. Many authors use “inconstancy”, while “changeability” is used by others. “Transformability” is used quite rarely. The difference in these expressions is mainly due to the fact, that the concept was discussed first in the German publications (M.F. Zaeh, N. Moeller, W. Vogl 2005). We hereby assume that the adaptability is the ability of production system to actively change its structure at all levels, at low costs in response to external and internal influences (H.P.Wiendahl (2002)). The concept should not be confused with that flexibility as well.

The look at Systems Engineering that flexibility is the opportunity to change the status and the adaptive is only the ability to change the status of a production system within a country (AM Ross, DH Rhodes, DE Hastings 2008) are not accepted in this article. Eventually it was decided to use the adaptability as the term highlights a positive direction of change within the machinery system and respond of external influences. Some authors accept different types and sizes of adaptability, namely spatial adaptability, temporal adaptability, structural adaptability and technical flexibility (R. Hernández Morales 2003).



In a wide aspect the “economic system” is a system of product, distribution and consumption of goods and services in the economic as whole. In another aspect, it is a set of principles and techniques through which the problems of the economic are addressed during the distribution of the final products¹.

In the economic the product is something that is designed to meet some needs and desires of the consumer and thus to bring economic benefits, which is interpreted as utility. Despite that in the economic theory all products are considered to be tangible in the real world some products, such as the information may exist in the intangible form. The products are able to be physically delivered to the consumer. Products, which are economically intangible assets can be only delivered, consumed. Most of the products consist of tangible and intangible components as one of them always prevails. This determines whether the product is a good, service or idea. In this sense, the services are determined as intangible dominated products. Moreover, the service is considered intangible equivalent of the products. Provision of service is an economic activity, where the buyer doesn't acquire as whole /except under especial contract/ ownership of what is bought, unlike the purchase of goods.

For some people the services mean serve or personal services, similar to servants, personal driver or cleaning and laundry. Today such an understanding is completely wrong. There are professional services as health, law, education, etc. There are high intensity in terms of capital services, such as banking services, vehicles, hospital care and others. There are common services, such as wholesale and retail. Only a small part of services (less 1%) refer to the personal services. In the economic literature can be found different definitions of service. According to us comparison with the economic benefits that today are considered for services, is incorrect. We accept the unmet needs of individual or the family for economic benefits and this is an interesting material for reflection.

Sometimes the services are named only as actions, not creation of a separate product, tangible object or tangible property. This is not true if the service consists of sewing clothes or making shoes of a material, provided by the client. Quite often a person can meet in everyday life a definition of the service, as performance, work, deed and action in general. Obviously, this definition is too general. Above all, it is noticeable for the one, who is trying to divide the general in these types of activities, according to the different classifications relate to services. For example, a service is considered the management of financial assets of the client, sew of individual models clothes, mounting of washer and training. The sites and results in examples differ significantly. They can be rightly called services in accordance with the practical application and utility. One of the famous researchers K. Grenoos describes the

appearance of the official statistics in the field of services as follows: “what has not been included in industrial and agricultural sector was called services”. Up to now, assessment of the contribution of the field of services to the national economy sector continues to have a similar image, which the cited author himself fairly called old (Mark Joyner).

The dynamics of market relations that are directly related to economic problems covering the profit, turnover of the business, pricing, quality of the workforce, costs, the realization and marketing, financial and other elements, typical for microeconomic level. The analysis of elements and the relation of companies to business activity “production of industrial products”, puts in turn some problems.

- *The first problem* is related to selection of criterions that ensure consistency between the different elements of the system – resources, labor and requirements.
- *The second problem* is concern the justification of specific mechanisms for rational use of base, resources and professional capacity of the workforce.
- *The third problem* requires an answer to the question: which factors influence the market and how they interact themselves.

The most essential ability of the economic enterprises of industrial field is the specific character of the raw materials base (national and imported raw and materials) and the production organization and distribution system for finished products. This specification requires creation of specific channels for the storage and sale of different types of industrial products. For this purpose, are required specialized warehouses, depots and transport.

The adaptability of these systems is determined of their ability to perform effectively the functions specified in the range of changing conditions.

External environment can require registration of other products or provision of other services. Low level of adaptability where the organization cannot or does not want to adapt to changes in environment a is threat to survival.

The main purpose of each system for measurement is to provide feedback to goals, which increases chances for the achievement of these goals, effectively and efficiently. The measurement becomes real value when used as basis on timely managerial decisions. The measurement is not Essence, and improve!

The final aim of the implementation of a system for the measurement of performance is to improve the competitive ability of the production system. In theoretical and applied aspect are presented numerous marketing approaches and indicators to measure adaptability of production systems output. We accept unquestioningly these results, but we believe that they may be supplemented in order to refine approach to the place in the competitive struggle. We offer follows indicators:

- Effectiveness – of the output of the machinery production systems this indicator can be presented in

¹ Economic systems, *The New Encyclopædia Britannica*, v.4, <http://bg.wikipedia.org/wiki/%D0%98%D0%BA%D0%BE%D0%BD%D0%BE%D0%BC%D0%B8%D1%>

quantitative of net measures of net cash income (sales minus the turnover tax) from the implementation of the machinery products /services/.

• Efficiency – comparing the efficiency with the costs, however for the implementation of products /services/ only, as we only assess the output of the presented production system. Here we can offer the following formula:

$$K_{\text{coef}} = \frac{Av(n)}{c} \geq K_{\text{tp}} \quad (2)$$

where:

K_{coef} – coefficient, characterizing the efficiency of the output of the machinery production system. [coef.]

Av(n) - pure /net/ added value for research period [BGN]

c – cost of marketing a product /services/ of the machine production system. [BGN]

K_{tp} – industry profitability coefficient of the machine-building sector /if necessary – specification by type products or services/ [coef.]

With these unparticular additions we can close our idea s developed in three stages of methodological approach in the previous and this article. The presented indicators for adaptability evaluation of input, the technological subsystem and the output of the system machine-building enterprise can be realized in new methodical and applied aspect through the prism of the benchmark. For this purpose can be applied the additional method of pattern recognition and developed by the function of the distances of M. Krumova. It is based on available /discriminatory/ information regarding the presented indicators for evaluation of adaptability in the present and previous articles about an economic enterprise. On this basic can be determined recognizable images of the enterprise and their indicators /discriminative features/ of type $g_i(A)$. The environment consists of M sets /enterprises/ - classes (R_i , $i=1,2,3\dots M$), which allow their presentation with the help of support vector – images $\vec{A}_0, \vec{A}_1, \vec{A}_2, \dots, \vec{A}_M$. Discriminant function $g_i(A)$ is determined by the distance $D_i(A)$ of the formula:

$$D_i(A) = \sqrt{(\vec{A} - \vec{A}_0^i)^2 \cdot (\vec{A} - \vec{A}_0^i)} \quad (2)$$

It can be represented as follows:

$$g_i(A) = \vec{A}_0^i - \frac{1}{2} \left(\frac{A_0^i}{A_0^i} \right)^2 \cdot \vec{A}_0^i \quad (3)$$

where:

A – vector, represented with points of Cartesian system, as each point represents the standard criterion for the quantity of specific indicators of adaptability of the enterprise.

A_i – vector, represented with points of Cartesian system, as each point represents parameter for indicator, characterizing the specific object /enterprise/.

D_i – distance between the best result /standard/ and the quantity of the indicator for each specific enterprise.

On this basis can be realize analyses and selective approach, with which to identify the indicators for competitiveness of each machinery production system and its place in the competitive classification.

In this field we can note the specific example of middle competitive position of machinery production systems of average statistics

In this direction we can note the specific example of middle Competitive position of machine production systems at the average statistics of the European Union²:

- Increase of quantity /size/ of sales by 10%;
- Reducing production /conditional permanent/ cost by 5 %;
- Increase of pure revenues /without turnover taxes/ to 7%;
- Increased coefficient of rate of return /of the profitability of the sole traders/ by 2%.

And all this in terms of financial and economic crisis!³

III. CONCLUSION

With this article we make a modest attempt to close the selection of theoretical results and leading practices in developed countries, as well as the arguments regarding the adaptability of machinery production systems in Bulgaria. It's obvious that in order to survive in the ruthless competitive fight a lot of efforts should be made both with regard to the marketing and economic indicators and to a specific clash with producer of specific products /services/. In this article, we offer two new indicators in terms of the subject of evaluation – an indicator of substantiation of economic effectiveness and efficiency, we offer the idea of comprehensive methodological approach, basis on the benchmarking and in particular the method of distance.

According to author of this series the articles are logical synthesis, creative idea and interpretation of methodological approaches of essential for applied research in Bulgaria. In this sense, the proposed series of three articles was not supported by experimental studies. Depending on accepted or rejected ideas of researchers and practitioners in the country shared in these articles will be directed experimental work of the author and led by a team.

² <http://rex.vniigim.ru/HTML/om3.doc>

³ <http://rex.vniigim.ru/HTML/om3.doc>



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