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THE CONCEPT OF COMPETITIVE MANAGEMENT FOR MANUFACTURING SYSTEMS

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ABSTRACT

Competitiveness is a general characteristic of enterprises, ensuring their viability. In economic literature, competitiveness is particularly analyzed from an economic and managerial viewpoint, dealing with or not mentioning at all the role of the technology in the assurance and increase of competitiveness, appears necessary to manage the manufacturing systems based on comportamental modeling. The comportamental approach is based on continuous acknowledgement of the situations and on activity decisions made in real-time. Thus solutions can offered for developing the competitiveness of the manufacturing systems based on theories about knowledge and complexity. Comportamental management is characterized through the ability to perceive the environment, making decisions on to the time, according interactions, and without having specific procedures. The environment of the system delivers on-line data considering the undertaken actions which will generate, when they are analyzed and correlated, solutions for the system to obtain increase of competitiveness.

KEYWORDS: competitiveness, competitive management, manufacturing system

1. Introduction

This paper presents a new approach of technical-economical competitiveness for manufacturing systems, and a new type of competitive management of them, so that their technical-economical performance should be maximized.

On worldwide plan, enterprises are confronted with a dynamics more and more accelerated and with unpredictable changes. This is influenced by the technical and scientific progress, dynamic requirements of the customers, science of management and mathematical economy [1]. These changes enforce an aggressive competition to the global scale what assume the request of a new equilibrium set between economy, technology and society.

The characteristic aspects of the present market, in particular the mechanical parts market, are the following: i) the current dimension of requests is continually decreasing, which leads to composition of the manufacturing of small series; ii) emphatic tendency of personification of products drives to a marked diversity of forms, of sizes and other characteristics of the mechanical components requested by the market; iii) the flexibility, efficient drive of the manufacturing systems tending to become the characteristics that decisively determined manufacturers competitiveness concerning components and building mechanics on market. The current dynamism of industrial and business environment represents the big global provocation which we must manage.

In the world there are the prestigious research centres on competitiveness, such us: Centre for International Development - Harvard University USA, European Institute of Technology with its centres in Cambridge, Geneva, Oxford and Organizational Competitiveness Research Unit of Sheffield Hallam University- Great Britain, which approach the competitiveness at global, regional level up to enterprise level. But, approaches, are economical and managerial and they noticed a link with technical aspects of competitiveness.

At this moment the algorithm for technical-economical competitiveness evaluation is not defined and, more technical factors are not taken into account, actions with answers short term, don't allow any time for analysis of pertinence statements

Consequently, it doesn't manage for a long time.

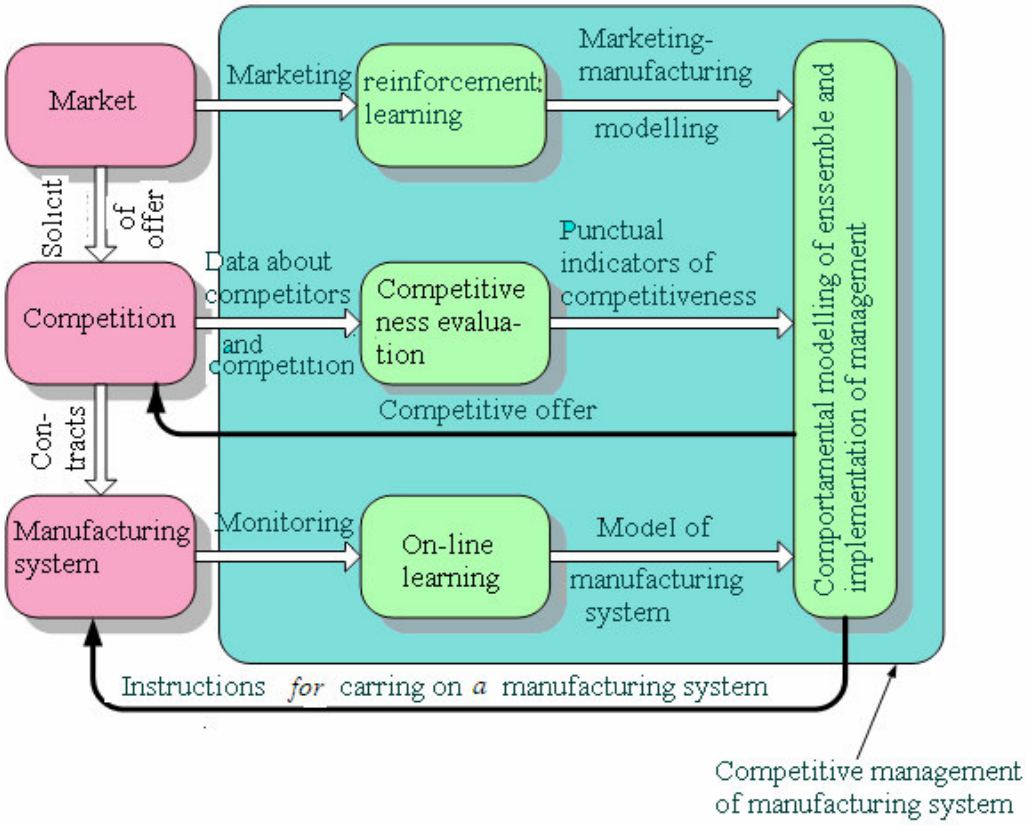

Fig. 1 Block scheme for competitive management

as well as consumptions and expenses caused by the technological processes generated by the technical actions [2], [3], [4], [5], [6], [7], [8], [9]. In this context, competitiveness notion has new valences, because it assembles the factors and politics which determine the enterprise capacity to occupy a favourable place on market, to keep that place and to improve the position. Unless the competitiveness characterizes synthetically and completely the viability of enterprise.

It is not known an algorithm of management of ensemble manufacturing system- market, but only an algorithm of technical management of the manufacturing system and of the economic relation with the market [14]. Today the manufacturing systems are driven through the programs of the machines tools with numerical program [15], [16]. Management is an exclusive technique because there isn't any economical variable which in fact is an ultimate consequence. Dynamic changes and the general progress of society translated to the level of the enterprise through many comands such as the little volume, great variety, obtained through frequent It is enforced a method of the fluctuant on-line, prompt reaction, speed management [12]. The dynamism from the market is transmitted to the management.

2. The development the of a new concept of manufacturing system management

Competitive management is a concept allows an enterrise to obtain a maximum profit understood as the profit be the difference between the sale price of the product and its manufactural cost.

The application of the competitiveness management at manufacturing system of the mechanic buildings can lead to a management of these systems. The authors of the paper propose a block scheme and based on which competitive management algorithm can be elaborated, figure 1.

Watching each line from block scheme (figure 1), we can see the following: the modelling algorithm of the market-manufacturing system relation includes data base from economical environment (auctions), extraction of knowledge through data mining and

realisation of the model through reinforcement learning; in order to punctual competitiveness indicators data bases will be constituted from competition environment and will extract knowledge to evaluate the competitiveness; the offers from the market enter in competition environment to generate contracts for manufacturing system; the modelling algorithm of the manufacturing system is realised leaving from the contract specifications and identifying the system.

The algorithm will be able to materialize through relations system between numerical values of the hexogen and endogen factors of the manufacturing system taken over from reality, through the modelling of the manufacturing system- economical environment relation, on one hand, and functional modelling of the manufacturing system, on the other hand. The algorithm is based on the reinforcement learning method and on-line learning. The testing of the elaborated algorithm will be done through the simulations on the virtual enterprise.

In reinforcement learning [2] the machine interacts with its environment by producing actions a_1, a_2,…..These actions affect the state of environment, which in turn results in the machine receiving some scalar rewards r_1, r_2,…. The goal of the machine is to learn to act in a way that maximizes the future rewards it receives (or minimizes the punishments) over its lifetime. Reinforcement learning is closely related to the fields of decision theory (in statistics and management science), and control theory (in engineering).

The stages of the algorithm are:

- the determination of the relations of the manufacturing system with economical environment through reinforcement learning;
- the determination of the relations results from functional modelling of the manufacturing system;
- the determination of the system of relations among the groups of endogenous and the exogenous factors of the manufacturing system.

In general, the learning process is an action, which improves the capacity of reaction of the manufacturing system, so that, at subsequent solicitations, it should undertakes increase actions with its efficiency. Conception of methodologies of modelling in real-time, based on reinforcement learning, for relation of the manufacturing system with economical environment, it means that the manufacturing system "learns" what to do in certain situations, based on given data of economical environment, so that the undertaken actions should lead to an increased possibility of reaching the suggested aim. The system must "exploit" what it knows that has already obtained the profit, but it must in the same time " explore" the possibility of finding other future actions. The manufacturing system must try a variety of actions and then choose the optimal ones.

For most industrial companies, the estimation method of the cost determines especially the performances of two strategic functions: product design and the offer (the price of product). In general, it is commonly admitted that product design can engage up to 70-80% of the total product costs. The recent progress achieved in Integrated Engineering such as concurrent engineering or integrated design opens a new field for cost estimation during the design stage.

In a competitive market, the incapacity of the company to quickly and adequately answer the request for quotation can echo severely on its capacity to survive economically. Indeed, an underestimated cost will result in losses while an overestimated cost will prevent the company from remaining competitive. So, there is a strong need expressed by industry to have sound cost estimating solutions, both in terms of design and quotation, that can improve the performance of these strategic functions.

To face this need, and to replace the analytical-based methods commonly used in manufacturing process planning, many companies apply parametric and analogous cost estimation methods. These methods are really fast because they are essentially synthetic, they provide the total cost of the product according to some of its characteristics.
After a detailed study of the cost estimating problem in mechanical engineering, it can be concluded that two support models are required: a knowledge model and reasoning model.

In manufacturing, cost estimating is the art of predicting what it will cost to make a given product or batch of products. Various techniques exist for cost estimating. The manufacturing cost of a part can be estimated using one of four basic methods: intuitive, analogous, parametric and analytical.

The comportamental approach is characterized by an ability to perceive the economical environment and make real-time decisions about tasks.

The competitive management includes and is based on comportamental modelling and on-line learning, and it is necessary to know in every moment the manufacturing system state, namely the relation between its capacity to function at the performance optimum parameters and economical environment, suddenly, in a given situation.

The answer at this necessity is generated by the mathematic evaluation methodology of the technical-economical competitiveness of a manufacturing systems in a given frame. In the concrete case of the manufacturing system, the performance can be evaluated through profit rate P, given by the relation:

$$P=(p-c)q \quad [Euro/hour] \qquad (1)$$

where p is the price, c is the cost and q is the productivity.

Comportamental modelling offers the possibility that the modified attributes that allowed the control and management of variables should be used for functional system setting, for optimal values of competitiveness achievement.

In order to verify the accuracy and applicability of the concept of competitive management of the manufacturing systems, it is necessary to obtain results on a concrete case. In this sense, it is simulated and modeled a real manufacturing system of a pilot enterprise which works in the real conditions on a real market with values of parameters tacked from the economical reality.

3. CONCLUSIONS

In this context, competitive management can offer solutions for development and competitive enterprises. Through this type of management the technical phenomenon is associated with the economical phenomenon.

Increased competitiveness is not a process with short-time advantages but it appears as a complex process and constitutes the support of an economic structures based on capital investments, on scientific research, development and innovation. It is obviously necessary to put in the correlations between economical average (the market, competition) and the manufacturing system and to study the role which they have in the acquirement and the increase of enterprise competitiveness. This becomes even more pressing due to the fact that, as the specialized literature points out, studies about competitiveness at least to the level of the enterprise and studies about process and technology of manufacturing system don't make the connection between the two entities in the context of the technical economical competitiveness.

The paper develops the notion of competitive management of the manufacturing system through comportamental modelling and on-line learning. .

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