

# Concerning the Competitiveness for Manufacturing Systems

Daschievici Luiza, Ghelase Daniela

**Abstract** — On world wide plan, enterprises are confronted with a dynamics more and more an accelerated and unpredictable of the changes. This is influenced by the technical and scientifically 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 settlement of new equilibrium between economy, technology and society. For the survival in actual complex and unpredictable environment, the manufacturing system must have the capacity of quick reaction in the sense of resituating on the favorable position on the market. The acquirement and preservation of this capacity is the most difficult overture for enterprises, because he involves many endogenous and exogenous factors and the process is continuously, dynamically and difficult predictable. The aim work is the achievement of modern and general approach of technical-economical competitiveness of the manufacturing systems taking into consideration the dynamic of the interaction factors from the economical environment.

**Index Terms** — competitiveness, competitive management, manufacturing system.

## I. INTRODUCTION

On world wide plan, enterprises are confronted with a dynamics more and more an accelerated and the 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 settlement equilibrium between economy, technology and society.

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

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

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Through manufacturing system understand the technological systems ensemble, which are used for obtaining of particular product. Each of these technological systems is composed of machine tool, tools, appliance, parts, operator and manufactures one of technological process operation for realization of the product. The manufacturing system is composed when the product is started into manufacturing and stay in this structure just up to the completion execution produced respectively. After when another product is started, the problem of manufacturing system structure is rerun from begin.

In literature, a manufacturing system is competitive on a certain the market when it obtains certain economic indicator: encipher of business, profits, segments of the comparable his superior market with one have another competitors. The approaches of the competitiveness problem [2], [3], [4], [5], [6], [7], [8], [9] show that, in this time, the competitiveness is defined though economical factors and indicators obtained and it is a suggested notion than numerical evaluation. In world exist the prestigious research centres of competitiveness, such us: Centre for International Development - Harvard University USA, European Institute of Technology with its centres from 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 nature, unless noticed the link with technical aspects of competitiveness.

In this moment the algorithm for technical-economical competitiveness evaluation is not defined and, more the technical factors are not taken into account, also consumptions and expenses caused by the technological processes are generated by the technical actions. 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.

## II. THE ALGORITHM OF COMPETITIVE MANAGEMENT WITH APPLICATION TO THE MANUFACTURING SYSTEMS OF THE MECHANICS BUILDINGS PROCEDURE FOR PAPER SUBMISSION

Through application of the competitiveness management at manufacturing system of the mechanics buildings, can release a management of these systems. The authors of the paper propose a block scheme and on its base can elaborate a competitive management algorithm, figure 1.

The manufacturing system receives contracts after auctions of the market. The competitive management system means the competitiveness evaluation and, on the its base to action on manufacturing system through instructions about

caring on mode of the manufacturing process to obtain maximum competitiveness. On the other hand, in about the competitiveness evaluation, the management system must give the elaborate possibility of the competitive offers which will enter in auctions. To realise these two objects, the competitive management system uses reinforcement learning method to know the market and on-line unsupervised learning method to know the manufacture system. The next step is the comportamental modelling of the system for elaboration of the necessary adjustment instructions of the technological process and management politics. Watching each line from block scheme (figure 1), we can see the following:

- the modelling algorithm of the market-manufacturing system relation includes using the data base from economical environment (auctions), extraction of the knowledge through data mining and realisation the model through reinforcement learning;
- for obtaining of the punctual competitiveness indicators will be constituted the data bases from competition environment and will extract knowledge to evaluate the competitiveness;
- the offers from 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.

Using data mining, will be obtain data set about functional and economic parameter, the dates which will be used for development of the model through unsupervised learning methods.

On base of above learning processes will be realise the comportamental modelling of the ensemble of the manufacturing system – market and a possible implementation of the management system. The manufacturing system will receive instructions about the way of development of manufacturing processes to achieve the maximum level of the efficiency (maximum profit).

The algorithm will be able to materialize through relations system between numerical values of the hexogen and endogen

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.

### III. CONCEPTION OF A METHODOLOGY OF MATHEMATICAL EVALUATION AND THE ON-LINE IDENTIFICATION OF TECHNICAL-ECONOMICAL COMPETITIVENESS OF MANUFACTURING SYSTEM

The competitive management includes and bases 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 evaluate through profit rate  $P$ , given by the relation:

$$P = (p-c)q \text{ [Euro/hour]} \tag{1}$$

where  $p$  is the price,  $c$  is the cost and  $q$  is the productivity. This relation will be analysed in connection with other aspects, such as, investment amount and business efficiency,

For identification of system state relation, is necessary to establish and multiply of some manufacturing system attributes – productivity, quality, flexibility, saving, predictability both its with external environment attributes-owned market section, the evolution of client requirements dynamic, market price, concurrent systems.

These attributes are state variables of systems with which is operated through their logical connection, the state relation is determined which define in a concrete mode the system competitiveness, which mean that a  $X$  product, at the moment  $T$ , on  $Y$  market in a concrete conditions.

Comportamental modelling offers the possibility that attributes which could be modified and became in this way control and drive variables, to be used for functional system setting, for optimal values of competitiveness achievement.

Mainly, the methodology of mathematical evaluation and on-line identification of competitiveness will generate solutions for competitiveness measures knowledge, in a concrete mode above explained, and based on-line learning and give to the management disposal dates and solutions to elaborate the politics which follow to get, to keep and to increase the technical-economical competitiveness level.

### IV. CONCLUSION

This paper proposes a modern approach about manufacturing system competitiveness because:

- manufacturing system competitiveness is approached in a new manner, original by using investigation modern methods, which are taken into account all the factors which influence the realisation, keeping and increasing of industrial enterprise competitiveness;
- is proposed a mathematical evaluation methodology of technical-economical competitiveness of manufacturing system;
- is proposed a new management concept of manufacturing systems, based on comportamental modelling of ensemble of

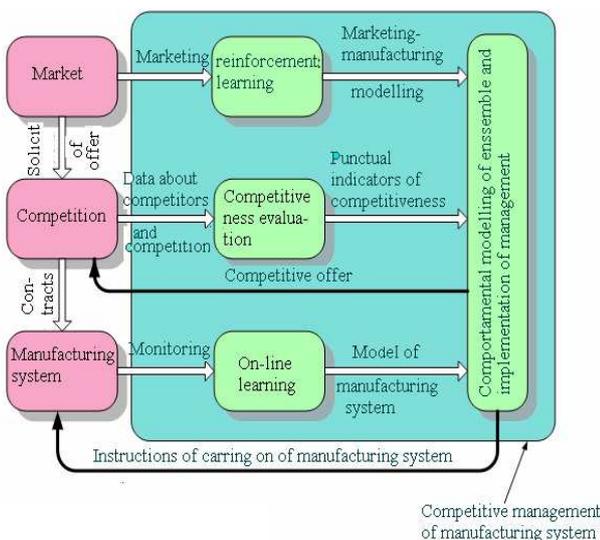


Figure 1 Block scheme for competitive management

factors of the manufacturing system taken over from the reality, through the modelling of the manufacturing system-economical environment relation, on of part, and functional modelling of the manufacturing system, on the other hand.

manufacturing systems-market and management setting at the manufacturing system level, which is all levels applicable and proper to the actual market requirements.

#### REFERENCES

- [1] Wooldridge J– Introductory Econometrics: A Modern Approach, Mason:Thomson South-Western, (2003)
- [2] Gi-Tae Yeo, Roe M.and Dinwoodie J. - Evaluating the competitiveness of container ports in Korea and China Transportation Research Part A: Policy and Practice, In Press, Corrected Proof, Available online 14 February 2008
- [3] Seong Kon Lee, Gento Mogi and Jong Wook Kim - The competitiveness of Korea as a developer of hydrogen energy technology: The AHP approach Energy Policy, In Press, Corrected Proof, Available online 28 January, (2008)
- [4] George F. Georgakopoulos - Chain-splay trees, or, how to achieve and prove  $\log\log N$ -competitiveness by splaying, in Information Processing Letters, Volume 106, Issue 1, 31 March 2008, 37-43.
- [5] Toly Chen - Evaluating the mid-term competitiveness of a product in a semiconductor fabrication factory with a systematic procedure, Computers & Industrial Engineering, Volume 53, Issue 3, October 2007, 499-513.
- [6] Meng-Rong Li and Yue-Loong Chang - On a particular Emden–Fowler equation with non-positive energy  $u'' - u^3 = 0$ : Mathematical model of enterprise competitiveness and performance, in Applied Mathematics Letters, Volume 20, Issue 9, September 2007, 1011-1015.
- [7] Christoph H. Loch, Stephen Chick and Arnd Huchzermeier - Can European Manufacturing Companies Compete?: Industrial Competitiveness, Employment and Growth in Europe, in European Management Journal, Volume 25, Issue 4, August 2007, 251-265.
- [8] Rodney Anthony Stewart - IT enhanced project information management in construction: Pathways to improved performance and strategic competitiveness, in Automation in Construction, Volume 16, Issue 4, July 2007, pages 511-517
- [9] Lawton T. - European Industrial Policy and Competitiveness, London, Macmillan Press, (1999)



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