PRODUCTIVITY RAISING APPROACHES IN THE LOGISTIC PRODUCTION SYSTEM

Miroslav Rakyta[*] *& Felicita Chromjaková*[**]

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This paper deals with the productivity of the logistic production system. The aim is to define the intermediate state of the production machines and equipment (OOE), identification of the material flows, idle time and breakdown forecasting, with the following purchase of the required spare parts. The goal of the system is the satisfaction of the customer´s needs and the minimalisation of not fulfilling the required terms for delivery with simultaneous increasing of the logistic production system productivity.

1. INTRODUCTION

All over the world there have arisen many approaches, techniques and methods supporting productivity growth. A lot of them are known in our country thanks to promotion and practical applications. However, the practice shows – the simpler the tool or techniques are, the more effective the achieved result is. The CIL (computer integrated logistics) belongs among the means of how to minimise the idle times of machines and equipment.

2. PRODUCTIVITY OF THE MACHINES AND MACHINERY

The main defect, experienced by many enterprises in practice, is the fact that the rising problems are solved immediately and not according to the connections, which the new solutions evoke (or break). Certainly, there exists a

[*] Ing. Miroslav RAKYTA, PhD, Department of Industrial Engineering, University of Žilina, Moyzesova 20, 010 28 Žilina, Slovak Republic, Phone: +421 089 5253541, Fax: +421 089 5253541, E-mail: rakyta@fstroj.utc.sk

[**] Ing. Felicita CHROMJAKOVÁ, PhD, Department of Industrial Engineering, University of Žilina, Moyzesova 20, 010 28 Žilina, Slovak Republic, Phone: +421 089 5253541, Fax: +421 089 5253541, E-mail: chromjak@fstroj.utc.sk

broad series of problems which should be solved. However, if we want to increase productivity, we must take into account what we have in the workplace, but first of all we must consider our competitor's action and which information conditions we have created.

There are only a few enterprises able to show an efficient and functional quality control system, enterprise logistic system, team work, TPM, etc. As it is not introduced into practice, in the area of enterprise logistics, it is due to:

- process description (logistic chain),
- standardisation indicator determination,
- determination of the demanded goals by process improvement,
- system for solving the deviations from the required goals (Table 1),

Table 1: Losses of equipment productivity

Kind of productivity waste	**Productivity influences**
❑ planned idleness of the machinery	❑ number of changes ❑ duration of breaks
❑ push back of the machinery due to the planned preventive maintenance – down time	❑ content and need of the planned preventive maintenance
❑ push back caused by the planned revision (ordinary revision, general revision, etc.)	❑ number of the planned revisions ❑ their extent
❑ push back caused by the failure	❑ revision time ❑ idle time ❑ workplace preparation time
❑ reduced tact times/time periods	❑ machine defect ❑ missing parts, semi-products, material asked by the service
❑ unsatisfying product quality	❑ following overwork ❑ waste increase ❑ increase of claims and costs

- application proposal for methods and tools in the enterprise logistics,
- employees' motivation by the problem solution,
- machine and equipment analysis in connection with the purchase logistics and the enterprise competitiveness (Figure 1),
- integration of the particular activities for increasing manufacturing productivity and decreasing costs (Figure 2).

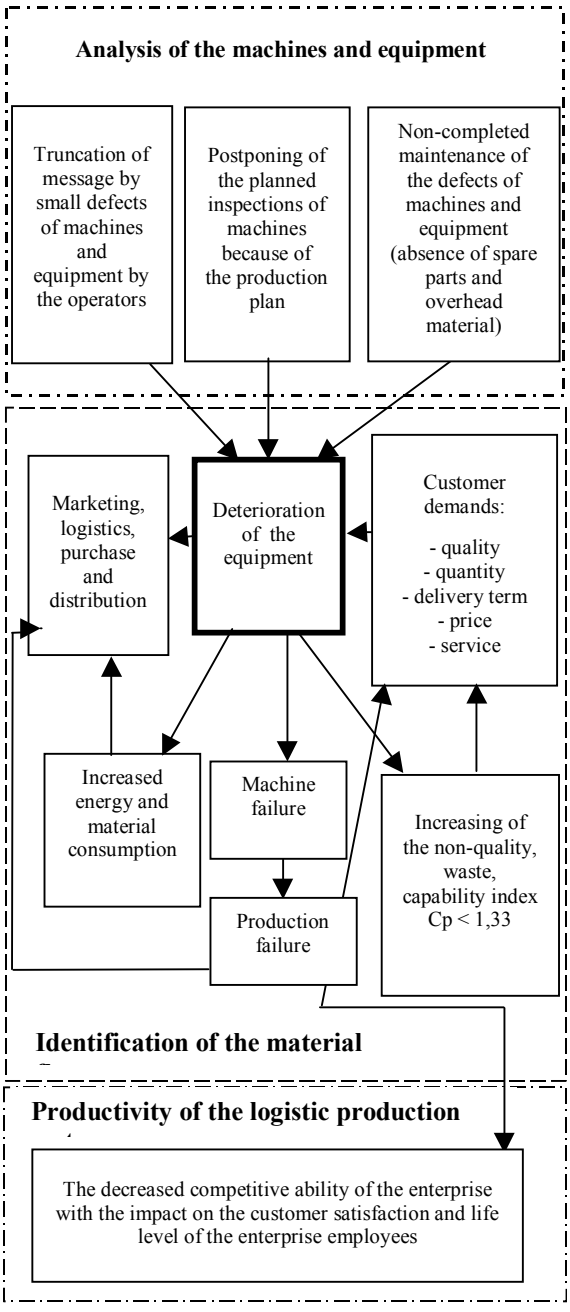

Figure 1. Influence of the state of machines and equipment on the customer satisfaction and the productivity of the logistic production system

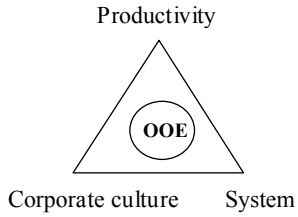

Figure 2. Integration of individual activities for productivity and quality increase and 0-cost decrease

The importance of the machine state and maintenance by productivity raising is directly dependent from the effective team work and finally influences the competitive ability of the enterprise (Figure 3).

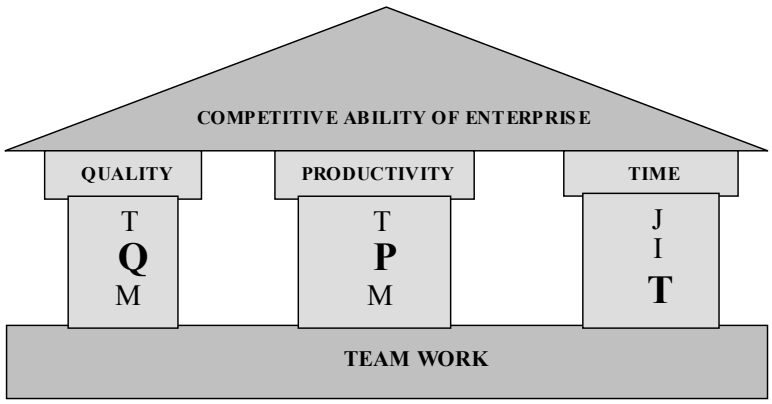

Figure 3: The importance and maintenance state by productivity raising of the logistic network

One of the possible accesses, which is directly used for the achievement of the mentioned goals, is **Total Productive Maintenance** (TPM). TPM is a complex of activities, including all enterprise units with the following objectives:

- the creation of such an enterprise structure, which provides the maximal efficiency of the production system,
- the elimination of noises, failures and all other losses by the equipment,
- sequential raising of the equipment efficiency,
- profit improvement,
- the creation of suitable work conditions,

- the motivation and involvement of all workers and all units from the labourer to top-management into process improvement,
- the obtaining of null losses through team co-operation.

TPM has a goal to maximise the efficiency of production machines and equipment; this is possible to obtain through the establishment of the consolidated system of a productive state, which exists during the whole production equipment life cycle.

Essence of TPM is comprised in Total Quality Control (TQC), Toyota Production System (TPS), also known as Lean Production and JiT (Just in Time).

What are the common characteristics of these approaches ?

1. **T** - total, full $\Rightarrow$ all enterprise labourers are involved in quality and productivity development, i.e. take part in the optimisation process;
2. The common **"null principle"** means: TQC - Zero Defect Production, TPS - Zero Waste Production;
3. Their principle reposes in the identification and **analysis of the primary reasons;**
4. They all come from the Kaizen philosophy, e.g. they follow the process of continuous improvement. TPM is a product of Kaizen and it is a through-product of the process of zig-zag improvement.

It is revealed that, in the following period, the primary orientation will emphasize production functions, and not only the maintenance. There are a lot of possible approaches, which can offer the basis for the acknowledgement of production functions. One of them is TPM. TPM – a merit of the mutual interface between the maintenance and production, extended on all enterprise processes - **TPM – MPM (Multiprocesses Maintenance)**, is based on teamwork, creation of the small groups and the analysis of the maintenance influence to the processes.

The main goals are to:

- degrade the material costs (positive influence on the production technology change),
- raise the machine and equipment usage, interruption reduction,
- raise the products and services quality,
- raise the multi-professionality of labourers in the production processes,
- degrade the maintenance costs,
- raise the operations and enterprise productivity,

- raise the enterprise culture and labourers' motivation.

The main goal of each enterprise is raising of productivity by minimal invested sources.

The seven pillars of TPM - MPM are:

1. valuation of the total efficiency of the machines and equipment,
2. analysis of the six great losses,
3. programme of the autonomy maintenance provided by equipment operators,
4. planned maintenance system,
5. system for the proposal of the preventive maintenance,
6. activity proposal for process improvement and creation of small groups for the machines and equipment efficiency raising (workshops, Kaizen) and
7. training for the skills raising for maintenance operators on the score of identification and operative solution of the primary noises and downtimes reasons.

The small TPM groups are non-formal people associations, which solve, on the free principle, special problems at the workplace and customer demands according to the internal and external customers. The goal of the small group is the maximal effort to satisfy the customer, as well as achieve the required outcomes and better productivity.

The advantages of the small groups are:

1. tracking and achieving group goals through effective team work;
2. improved division of labour and tasks co-ordination in the group;
3. improved communication between the personell and management, as well as improving communication between the workers of various generations, different functions (production, maintenance...), etc.;
4. improved working morale;
5. developed workers' co-operation through the better use of their knowledge and skills;
6. groups are profit sources, because they solve problems usually left to the management;
7. improvement of the relationships between management and organisations which represent the workers.

3. IDENTIFICATION OF THE MATERIAL FLOWS

Each material movement must be connected with the information. In all places, where the information is absent, the material flow and the inventory in

store are accumulated. Each material flow is optimal, when the information comes on time, at the right place.

The objective of material flow identification is the decrease of the redundant dates and the preparation and manipulation of all data for all planned manufacturing and controlling tasks in the whole production system. The identification of the material flows provides the following information about:

- production process quality control and management,
- machine and equipment reliability,
- machine and equipment capacity utilisation,
- inventory management and goods in process,
- production costs,
- work productivity,
- claims and customer satisfaction.

For the material flow manipulation as a complex of operations in the transport, loading, unloading and trans-shipment, warehousing, packing, measurement and quantity calculating and dispatch, we can determine the following principles:

- most direct and shortest transport routes without unnecessary crossing and reverse actions,
- exclude the unnecessary material handling.

4. CONCLUSION

Identification of the material flows and machines is the key factor of production system management. Thus, we can obtain a strong tool for the productivity increase in the area of the logistic chain productivity in the following areas:

- productivity increase - as a result of a faster and more flexible production planning and reverse linkage,
- production quality increase - as a result of a production process management on the basis of accurate and real information about the production (final products, semi-finished products, etc.),
- decrease of production losses - as a result of more precise information about processing of the individual manufacturing processes, machines and equipment,
- savings in material and overhead costs - as a result of a more correct monitoring of the material and value flows,
- decrease of production in operation and inventory state,

- better information for the top management - information about market development, the attained quality,
- acquirement of the strategic jump on competition,
- increase of the logistic production system productivity.

From these results, we can see that the identification and the state of the material flows and machines have their own place and it is a tool, which integrates the material, information and the value flow. In accordance to this fact, it enables the competitive ability from the production point of view and increases the productivity of the logistic production system.

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PRISTUPI POVEĆANJU PRODUKTIVNOSTI LOGISTIČKOG PROIZVODNOG SUSTAVA

Sažetak

U ovom se radu razmatra produktivnost logističkog proizvodnog sustava. Njegov je cilj definiranje prosječnog stanja strojeva i proizvodne opreme, identifikacija materijalnih tokova i izgubljenog vremena, te predviđanje kvarova i nabavke potrebnih rezervnih dijelova. Cilj čitavog sustava je zadovoljavanje potreba kupaca i minimalizacija narudžbi neispunjenih u dogovoreno vrijeme, uz istovremeno povećanje produktivnosti.