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RESOURCE PLANNING IN THE DEVELOPMENT OF MAINTENANCE STRATEGIES

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Abstract. Develop annual maintenance plan is a more difficult task than basic production scheduling as conditionality more extensive. Resource planning for maintenance activities should be clearly correlated with resource planning for the company's production plan. Adoption of maintenance strategy and within resource planning is carried out by the equipment failure rate and maintenance cost per unit time.

This paper supports the integration of resource planning for maintenance activities in the development of maintenance strategy, on one hand, and how their integration in enterprise resource planning, on the other hand. Addressing envisages evolving planning and inventory control that began with MRP system, passing successively through MRP II, then ERP and EERP system currently reaching, extensive planning of resources.

Keywords: resource, planning, maintenance

1. Introduction

Material resource planning aims to ensure a balance between consumption needs of businesses with material resources that can be acquired in order to meet the overall objectives of the respective units. Resource planning for maintenance activities should be clearly correlated with resource planning for the company's production plan.

This paper supports the integration of resource planning for maintenance activities in the development of maintenance strategy, on one hand, and how their integration in enterprise resource planning, on the other hand.

2. Resource planning for maintenance

In calculating resource planning production quantities of components must decomposition product classifications, ultimately causing the parts to be supplied. In this way you can plan and control inventories and capacities, achieving a feedback between the control and the ability to use the program for free (Figure 1).

The main purposes of resource planning method are to control inventory levels, operational priorities to associate different components and plan the carrying capacity of the production system [1]. These can be summarized as follows:

1. Inventory:

- Ordering play and semi-finished necessary;
- Ordering of quantity;
- Ordering at the right time.

2. Priorities:

- Ordering a suitable delivery date;
- Retention delivery available.

3. Capacity:

- Planning a full load;
- Planning a suitable load;
- Planning for a future anticipated loads.

Information necessary to achieve these objectives is of three types:

- Information on the composition of finished products and raw materials;
- Information on delivery dates, production and assembly;
- Information on the compatibility of operations with enterprise capabilities.

These three categories of information allow knowing if the production plan objectives can be met. Master production schedule provides the data on which the finished products are available and using the method to determine resource planning manufacturing data and parts availability.

In recent decades the maintenance function performed strongly under the effect of constraints of productivity, cost optimization and the influence of Japanese industrial design [2]. Now maintenance function whose purpose is to ensure the smooth running of the production equipment is one of the strategic functions of the enterprise [3], the main objective being to ensure equipment reliability, decrease the number of failures, and reduce cost revisions reinstatement in service. Mission maintenance function is completed by specifying that can be found in Coetzee (2004) [4]: "It is the

task of maintenance function to support the production of adequate levels of availability,

reliability and equipment operating at an acceptable cost."

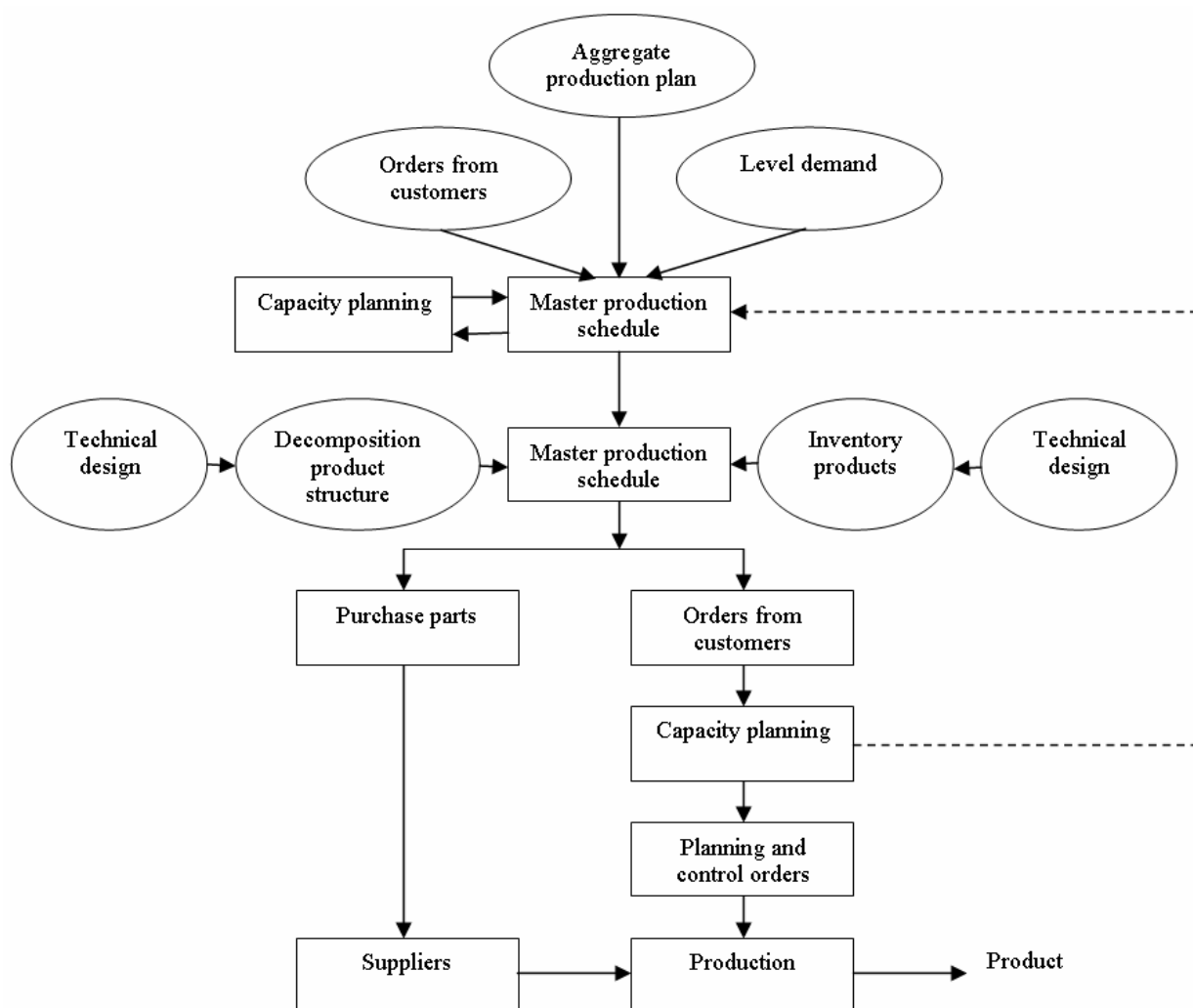


Figure 1. Production plan

Develop annual maintenance plan is a more difficult task than basic production scheduling as conditionality more extensive.

The main factors influencing annual maintenance plans and resources from planning objectives presented above are:

- Equipment number, types and groups existing production facilities;
- The duration of the production equipment;
- Record of previous failures and repairs;
- Possibilities for works.

Information on which annual maintenance plans are prepared and within maintenance plans to ensure resources can be grouped as follows:

- Maintenance information system applied technical condition of equipment and the equipment to be decommissioned;
- Information about the existence of material

for maintenance activities:

- Quantity of spare parts required for repairs;
- How to ensure the stock of spare parts and materials needed.

Resource planning for maintenance activities should be clearly correlated with resource planning for the company's production plan.

An example of resource planning maintenance refers to existing solutions on the international profile products computerization maintenance activity in general and resource planning activities for maintenance, in particular.

Some elements of such a software product are presented in the following.

The program contains a main window called the Master List, for entering data of own database entry [5]. Each category of data is individualized by a number identifying attributes (Figure 2).



Figure 2. Data input window

Figure 3 presents a list of production equipment belonging to the production system in response to

the query made by the user program on the subject.

Asset Number	Asset Description	Location No	Asset Category	Model No	Serial No	Status	Department	Purchase
000011	Strung SHB 400x1000	1	00001	1	26PR15	Active	P1	0.00
000012	Strung SHB 400x1500	1	00001	2	48PS25	Active	P2	0.00

Report Date: 5/12/2007 8:48:00 AM

Figure 3. Production equipment list

Figure 4 illustrates the creation of a new work orders for maintenance activity type transmission belt mechanical inspection of the equipment supplied.

Another significant example concerns how the

sheet maintenance intervention (FIM) used in the management of maintenance [MĂR 07], provides information resources for maintenance planning so that they are an integral part of the production resources in general (Figure 5).

Figure 4. Creating an order

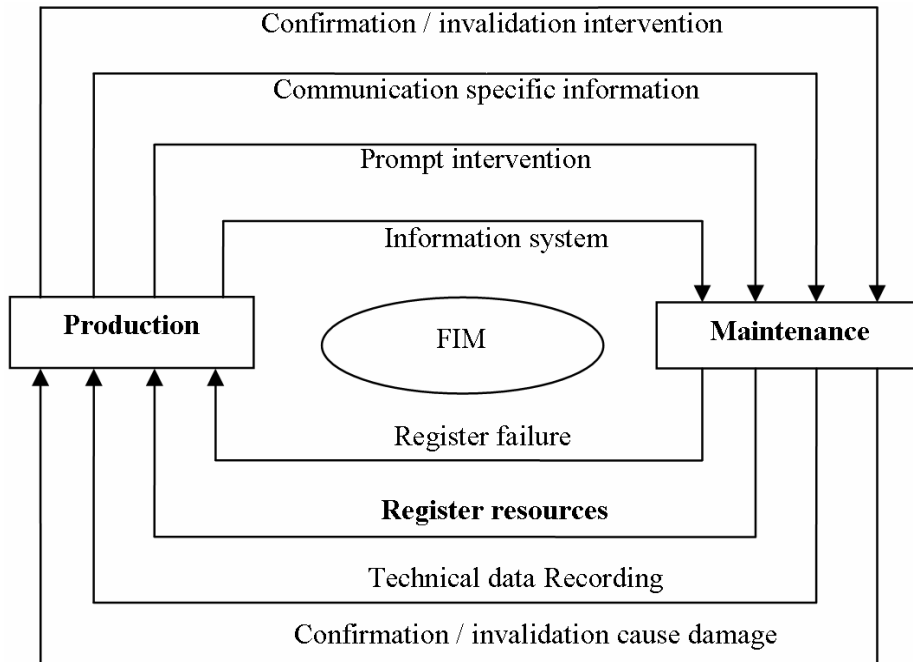


Figure 5. Sheet maintenance intervention - Relationship Production - Maintenance

Adoption of maintenance strategy and within resource planning is carried out by the equipment failure rate and maintenance cost per unit time.

For example, for equipment whose running time without fault is modelled by Weibull distribution, variations of maintenance strategy is established depending on the shape parameter β [6]. Thus, the failure rate function expression, characteristic Weibull model:

$$z(t) = \frac{\beta}{\eta} \left(\frac{t - \gamma}{\eta} \right)^{\beta - 1} \quad (1)$$

is observed that:

- $\beta = 1$ indicates a constant failure rate over time, which recommends corrective maintenance, risk of failure being the same all the time, even if they do or do not do preventive replacements;
- $\beta < 1$ defines a decreasing failure rate, which

justifies preventive corrective maintenance because after replacement, "risk of failure" due to defects youth will be higher than before;

- $\beta > 1$ indicates an increasing failure rate over time. In this case, the period of application set is calculated and compared to the cost of two strategies. It adopts preventive maintenance only if its cost is less than the cost of corrective maintenance.

3. Conclusions

This paper supports the integration of resource planning for maintenance activities in the development of maintenance strategy, on one hand, and how their integration in enterprise resource planning, on the other hand.

Addressing envisages evolving planning and inventory control that began with MRP system, passing successively through MRP II, then ERP and EERP system currently reaching, extensive planning of resources.

The example presented in this paper supports the need for maintenance resource planning integration in enterprise resource planning. It also supports the need for an integrated management of the business aspect underlying ERP system implementation. It made such an ERP fit seamlessly within the definition given in [7]: "software systems for business management, which incorporates modules supporting functional areas of business, such as planning, production, sales, marketing, distribution, accounting, finance, human resources management, project management, inventory management, service and maintenance, transport and electronic business (e-business)".

Scheduling and resource allocation improves work order scheduling and planning, providing a common planning preventive maintenance and initiating corrective maintenance. By integrating planning other types of resources can automatically compare the necessary materials, raw materials and personnel availability of different components which results in the development of an integrated management effectively.

References

1. Rădulescu, A. (2004) *Managementul producției (Production management)*. Printech, ISBN 973-718-110-7, București, România (in Romanian)
2. Kaabi-Harrath, J. (2004) *Contribution a l'ordonnancement des activites de maintenance dans les systemes de production*. PhD thesis. l'Université de Franche-Comté. Available at: http://tel.archives-ouvertes.fr/docs/00/25/95/16/PDF/These_kaabi.pdf. Accessed: 10/06/2013
3. Dijkhuizen, G.C. (1998) *Maintenance Meets Production - On the Ups and Downs of a Repairable System*. PhD thesis, Twente Universiteit, Nederlands. Available at: <http://doc.utwente.nl/20376/1/t0000004.pdf>. Accessed: 10/06/2013
4. Coetzee, J.L. (2004) *Maintenance*. Trafford, ISBN 978-1412023627, Victoria, Canada
5. Mărăscu-Klein, V., Toma, V. (2007) *Managementul mentenanței (Maintenance management)*. Editura Universității "Transilvania", ISBN 973-978-598-093-1, Brasov, Romania (in Romanian)
6. Toma, V., Mărăscu-Klein, V. (2008) *Method of setting up maintenance strategy*. Proceedings of The 19th International DAAAM SYMPOSIUM "Intelligent Manufacturing & Automation: Focus on Next Generation of Intelligent Systems and Solutions", ISSN 1726-9679, ISBN 978-3-901509-68-1, p. 1397, 22-25th October 2008, Vienna, Austria
7. Hossain, L., Patrick, J.D., Rashid, M.A. (Eds) (2001) *Enterprise Resource Planning: Global Opportunities and Challenges*. Idea Group Publishing, ISBN-13: 978-1930708365, USA. Available at: <https://faculty.biu.ac.il/~shnaidh/zoooloo/nihul/evolution.pdf>. Accessed: 10/06/2013