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Demand oriented factory planning through reference models

M. Abramowski
Chair of Factory Organisation, University of Dortmund
Emil-Figge-Straße 70 a, 44221 Dortmund (Germany)
Tel. 0231/755-5776, Fax. 0231/755-5772
e-mail abramowski@lfo.uni.dortmund.de

Abstract

At present, one can watch fast and extensive changes in the basic conditions for companies which are reflected by the unstable market and by the worldwide competition with internationally operating companies. Because of this, the fundamental problem of the companies is to guarantee a permanent reaction to the reqirements of the market. This results in the demand of reduced planning periods and a demand oriented start of reorganization activities in the current operation. The use of reference models for anticipation and simulation of factory structures and processes is suitable from the planning's point of view. However, to reach the whole rationalization potentials during the planning by using reference models, they have to be used along the whole logistic chain of order processing including all resources. The intention of the following article is to explain how the employment of reference models during and after the planning process can help to guarantee a high level of competitiveness.

Keywords

Factory organization, employee oriented planning, reference models, process orientation, EDP support within the planning process

Organizing the Extended Enterprise P. Schönsleben, & A. Büchel (Eds.)

1 INTRODUCTION

Shorter product life cycles, increased customer demands and the tightening of competition presently force companies to shorten the planning cycles along the logistic chain. According the target of bringing the factory and its systems increasingly in line with the products and the respective production processes, the necessity arises for the factory and its planning process to determine life cycles for single factory systems. Both the "time-to-market" of the product and the " time to market" of new factory structures have to be sped up.These structures provide the basis or a smooth order handling process and have to be optimized from the beginning of an new product life cycle (Figure 1). Goal requires these new methods and devices which can guarantee the competitiveness of companies. In the following chapters the reference models their use and the resulting advantages for the planning will be shown.

2 REFERENCE MODELS

The model of a factory is used within the methodical procedure. In order to explain the use of reference models within factory planning, reference models themselves are to be introduced in the following. A reference model can be characterized as follows: A reference model is a partly reusable and thus exchangeable demonstration model. One area of employment is the documentation of previous experiences in special fields. Reference models are characterized by an high accordance with other similar applications.

Reference models reduce the expenditure to create and apply these models and lead to advantages in time and cost. However, reference models for production and logistics can not be considered as ideal solutions; they can and have to be neither complete nor clear referring to their area of application. Decisive is the structured and general framework to locate the problem area, which offers both, openness for changes and constructs for conversion into procedurable models (for example simulation models).

A reference model as an exemplary general solution is never completely reusable because no company is exactly similar to another. Therefore it has to be possible to take the mentioned general models apart into functional partial models. (e.g. Potyka 1994) A reference model is built level by level from several reference (partial) models for single functions which are put together for the overall view.

The basic idea is comparable to the science of design in mechanical engineering (Koller 1985): The "whole thing" is built of components which again consist of single construction elements. If it is necessary to create a new product/model which is similar to an already existing one, entire components can possibly be reinserted into an adapted surrounding. If the new product/model is rather dissimilar to the existing one only single elements can be reused.

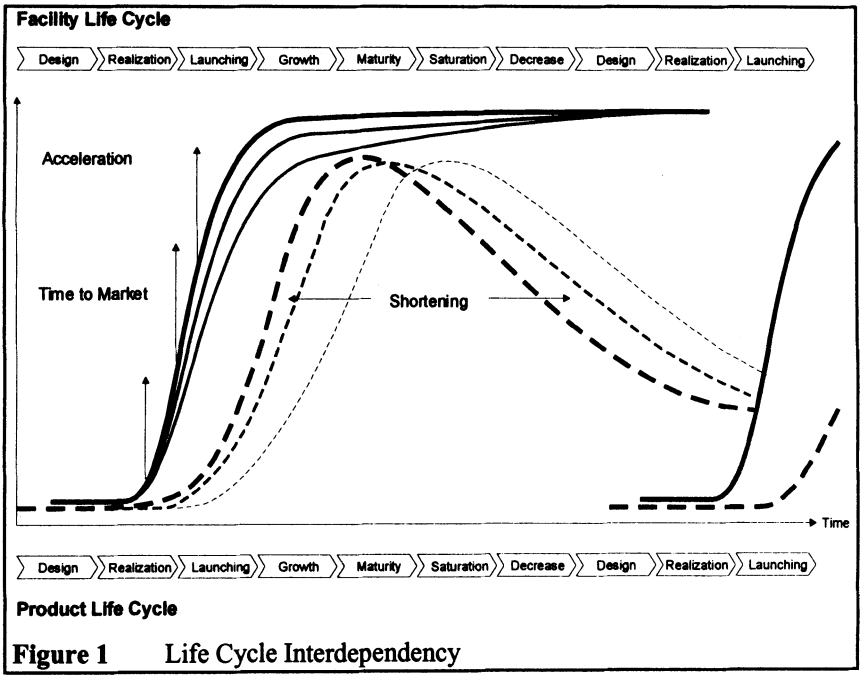

Figure 1 Life Cycle Interdependency

The more complete the catalogue of reference models is and the more systematically they are structured, the more efficient is the creation of a new general model. Like the constructor who can fall back on catalogues of construction elements and components, the planner can work with a number of reference models. They offer possible partial solutions which can be combined in an application oriented way with various alternative general solutions.

3 FACTORY PLANNING METHOD

To connect planning, realization and optimization of the factory system temporally with the lifetime and the "Time to Market" of the products, highest requests are set for the factory planning. That applies also to the planning methods and tools as well as for the planning management. The various demands can be transferred to the factory structures following these targets and can only be fulfilled if suitable planning methods are used and foundations for the following planning cycles are created through the building of reference models during the planning phase. The basis for demand oriented factory planning is formed through the interaction of planning methods and reference models. One of the foundations for demand oriented factory planning is a planning method which was created at the Department of Factory Organisation: the method of structured factory planning (Bissel 1997). This

method, which offers help via product and process oriented planning of factory systems and their adjustment to new demands, will be described in the following report:

3.1 Qualitative process planning

The aim of qualitative process planning is to define the various customers of the company and their performance demands as well as the definition of the processes of creating the performance for the customer. Since most companies produce products which differ clearly from each other in their amounts as well as their production processes, it is the task of qualitative process planning to work out these differences and convert them into demands on the factory structure (Bissel 1997).

The results of qualitative process planning are production processes per product or product range which are described in a systematically and structured way and demand profiles for the factory structures. The process descriptions are the basis for the following design of the system.

3.2 Structuring process and system planning

It is the aim of structuring planning to design factory systems in line with the production process as well as to assign responsibility for the production processes and the products. The structuring process and system planning is made up of two planning phases, the vertical and the horizontal structuring. The vertical structuring aims at determining; with the help of the created criteria; which products are pulled together inside one factory system, and which are the decisive criteria. The horizontal structure aims at defining the interfaces, and with them the system borders of single partial systems of the factory along the production process (Bissel 1997). The innovative potential, which is connected to this, can be described as follows:

- transparent process structures in clearly defined areas of responsibility;
- avoiding loss by friction through defined interfaces, precise distribution of tasks and co-operation agreements between factory systems, in the form of internal customer-supplier relations.

3.3 Quantitative system planning

It is the responsibility of quantitative system planning to dimension the capacity stock of the various resources in a way that the needed amount of capacity for running the processes is available in the factory systems and, at the same time, the economicality is guaranteed. Along with determining the technical capacities, it is part of quantitative system planning to define the need for personnel (Bissel 1997). Professional competence is most important here.

3.4 Dynamic system planning

At first, a predominant operational concept was developed for the factory systems, which is responsible for the creation of order pools (system load for a certain planning period) for the single factory systems. Using this as a foundation, the internal operational principles were designed. The design of the planning and operation system forms an important condition for the efficiency of the factory systems. The innovative potential, which can be opened during dynamic system planning, especially refers to the chance of not only being able to create the technical components of a factory. (Bissel 1997) It also adjusts the performance functions in the shape of planning operation and controlling functions in a way, that all important possible interferences within order processing can be avoided. In particular the simulation models can help here to optimize the control functions.

3.5 Networking system planning

After the factory structures have been determined, a communicative network has to be created internally and externally, to enable an information flow like in the qualitative process planning phase created. It is the predominant realization here that the factory structures have to be optimized first before the information networks can be created (Bissel 1997).

The aim of networking system planning is reached when the production processes are controllable through a simple, safe and need oriented information flow.

The use of reference models are an asset to planning methods. One the one hand, reference models are simulation models, and on the other hand, they are standardized business processes, structure plans as well as factory layout plans which result partly from the experiences of the planners and partly from the experiences of the industry companies. Thus, in the future the planning period will be reduced by using reference models, because the planner can fall back on planning elements and partly modelled but typical processes for various types of factories.

Furthermore, the decision period can be turned into a more effective one by the building of reference models in the kick off phase of a planning. The behaviour of central and decentral structures can be checked by feeding by various system burdens (for example: expected orders volume) into reference processes or simulation models. In this way, there can already be a statement made in the planning period whether, for example, a factory located in a central place should be restructured or be divided into smaller decentral factories.

4 DEMAND ORIENTED PLANNING

After the start up of a planned factory (following the realization of planned structures) the logistics structures will be checked by reference models. In this way the

action-requires for overplanning a part of a company can be verified. The result is a new way of factory planning from the unique planning via demand oriented planning with the help of reference models to plant support (key word: permanent planning).

A further main point to reach the aim mentioned above is the idea of permanent planning readiness. The thought of permanent planning readiness includes the demand for permanent up-to-date structures. It should be possible, for example, to react with the structures directly to changes concerning the products and processes. To guarantee a permanent planning readiness it makes sense to use the surplus out of reorganizational planning. This surplus can, for example, be taken out of reference models, which were created during the planning phase.

Moreover, a balancing of new, flexible reference model supported structures constitutes the basis for simultaneous engineering in order to be able to react quickly to the product changes expected by the clients.

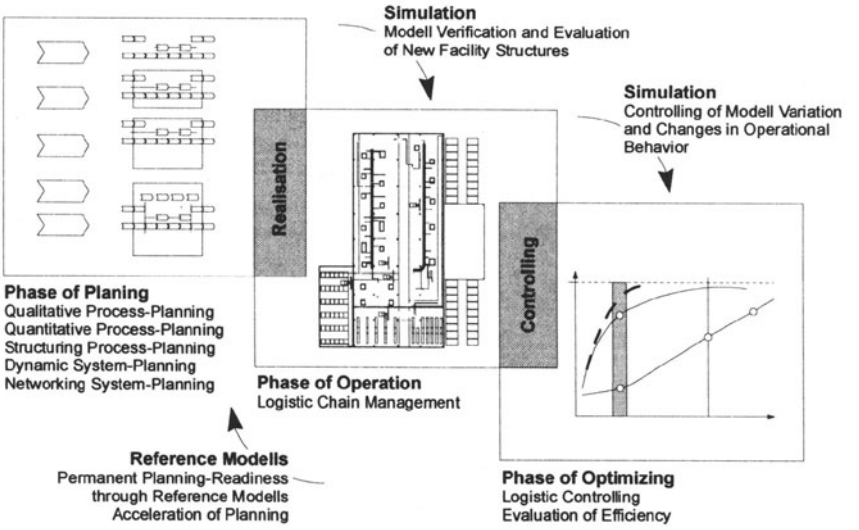

Figure 2 Demand oriented Planning

This idea is also confirmed by CIMOSA (König 1992), in which reference models are described as follows:

- A reference model for CIM supported in common by users and producers,
- Step by step elaboration and filling up of the reference model,
- The order of a migration track built up on current solutions,
- The opening of solutions for the change of corporate strategies and technology.

Now building on the thought of permanent planning readiness and the mentioned planning method, one can set route for the demand oriented factory planning. It is possible to check indication numbers through the use of different measuring points at critical areas in the company. During the control phase (figure 2: control) the actual value can be compared to the theoretical value - it is possible to react to changes within the operational behaviour. Planning demands can be recognized and the planning can be accelerated through the reference models, which have been created during the previous planning phases. This acceleration is based on the fact, that the actual value analysis does not have to be completely redone, but only the reference models need to be changed. The result is a control loop for demand oriented factory planning, which, for example, can be used to react to customer demands.

5 EFFECTS ON THE EMPLOYEE ORIENTED PLANNING

The use of reference models, which has already been mentioned, relates only to problem fields which are caused by superficial reasons for logistical difficulties (shorten product life cycles, changed production structures, entrepreneurial change and alterations in the surrounding). However they also can be used for cryptic logistical difficulties (underestimated complexity, insufficient understanding of the whole logistic, uncoupling of the flows of goods and information). Because without inspection of the cryptic logistical difficulties success in restructuring will be partially inevitable despite of entirety attempts. The reason is frequently the refusal of new structure concepts due to isolated group thinking and lacking understanding for the order process.

The employee has to identify himself with the whole process, if one wants to win him as an additional thinker and planner to open up the potentials of logistics. The "man" is the main component within the order process with the biggest potential of innovation and added value of which utilization for the planning activities accomplishes a good contribution . To be able to plan and realize structures, which are characterized by extended areas of responsibility as well as process orientation, the employees of a company, dealing with itemizing, in future have to be fixed up with an entirety way of viewing on the direct and indirect processes as well as the planning aims. Reference models are also a valuable contribution here. The most important feature of reference models in view of this problem is the possibility of building up various types of companies as structural and process organizational entirety systems.

Therefore, reference models are not only used for planning, but also for training. Reference models can be used within a device, which is universally suitable for the colleague training referring to this way of looking at a problem in a company, the principle of learn shop ($\Rightarrow$ practical workshops). The duty of an integrated concept is to display the various planning steps as well as the procedure of order process

systematically and consistent with an example. The use of this device allows to the visualization all the cases of application from the planning through to the start-up and to the control. At the same time, the reference models help the employees within the learning place to think not only cross-divisionally, but also to learn to abstract, in order to realize the necessity for changes referring to demand oriented planning. In the following fields of action the reference models can be used within an integrated concept of learn shops for explaining of new concepts:

- Quality Process Planning: In this part of the method the employees should be fixed up with the entirety process view and the method of Business Process Reengineering. The result is an entire view of the factory and its logistic.
- Structuring Process and System Planning: Here the problem of interfaces are described transparently and the necessity of new areas of responsibility are mediated. In addition to this, factory layout planning based on material flow can be shown by reference models. This is an important condition for the understanding of new structure concepts. The dynamical behaviour of the structures is shown by simulation.
- Dynamical System Planning: The best structures and the best layout of a company are valueless if the control as an aspect of an entirety form of expression, is missing. Particularly in this area, there are new tasks arising to the employees as a result changes in company structures. The control principles and concepts can be taught to the employees by simulation reference models and prepare individual employees for their new tasks within the company.

Thus, employees who should be in place in the planning period can be trained in advance on the new types of structure.

6 CONCLUSION

By the globally demand oriented planning approach one strives not only an over planning of parts of the company. It is also the planning of all the company by one hand with the help of the employees. Therefore, on the one hand the planning is accelerated and, on the other hand, a reorganization corresponding to demand oriented planning is ensured. The target of a demand oriented planning is that a comprehensive restructuring step has to be followed by many small ones (compare: demand oriented planning) to hold a long term competitive position and to improve it on the basis of regulating circuit structures.

In the course of the project the following has to become claer:

- what has to be improved permanently
- in which direction it has to be improved, and
- who does the improvement.

In this connection, the necessary correlations between employee and work oriented planning procedures as well as planning processes and the finding of strategic network knots have to be analyzed. As well faults within the current operation have to be recognized by the employees. These can be reflected in the reference models. Only then can the staff be sensitized to permanent planning readiness which is able to start the continuous improvement process by demand oriented planning.

In summary the following advantages result from this:

- by working with reference models the following reorganizations can be accelerated.
- further increase of flexibility
- support of strategic decisions, minimization of risks through precise planning results
- optimization of in /outsourcing
- feasibility studies on the basis of reference models
- verification of restructuring requirements
- reduction of planning periods

Outlook: In addition to the reference models in future element databases and reference number libraries have to be set up in order to standardize and accelerate futhermore the planning process. With this instruments also the basis for new regulating circuits is created, which are the basis for the demand oriented planning.

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8 BIOGRAPHY

Marcus Abramowski

1988	Study of Mechanical Engineering at the University of Dortmund
1989	Dipl.-Ing. / University of Dortmund
since 1995	Scientist at the Chair of Factory Organisation, University of Dortmund