PROALPHA® APS - THE ADVANCED TOOL FOR MULTI-RESOURCE-PLANNING AND REALTIME-OPTIMIZATION IN MIDDLE-SIZE ENTERPRISES

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Abstract*: Production planning departments have worked according to the same MRP philosophies for the past thirty years. Everyone agrees these are no longer adequate for today's business environment. Increased demand for customization and shorter lead times are conflicting goals to reducing inventory and optimizing capacity utilization. Systemic restraints prevent optimal planning. APS is short for Advanced Planning and Scheduling, the so-called multi-resources planning. The implementation of combined solutions are on the example of proALPHA® system discussed.*

INTRODUCING

Advanced Planning and Scheduling (APS) has been a buzz word in the ERP scene for about five years. Production planning departments have worked according to the same MRP philosophies for the past thirty years. Everyone agrees these are no longer adequate for today's business environment. Increased demand for customization and shorter lead times are conflicting goals to reducing inventory and optimizing capacity utilization. Systemic restraints prevent optimal planning.

Almost all production manufacturers see the problems of production planning. There are cures available for some individual symptoms, but existing approaches can not offer a comprehensive solution [1].

1. THE CONCEPT OF PROALPHA® APS

The main difference between classic MRP planning, which makes up the core of the very most ERP systems, and APS concept, which was implemented in proALPHA is on the figure 1 presented. The crucial point is a change of a complex, multidimensional, successive planning of the materials and capacities into one integrated multi-resource-planning with optimization of using of resources according to the goals of manufacturing company [5].

The reason for unsatisfactory planning results delivered by the most present-day systems is a deficient illustration of planning systems' reality across the manufacturing companies. Production flow modeled by these systems is derived directly from the bills of materials. Production part, which belongs (from constructive point of view) to a sub-assembly is in the first place assembled on the constructive site and when it's done completed respectively.

Fig.1. *Comparison of MRP and proALPHA® APS*
Source: self work based on [2]

Classical routines are based on sequential execution of individual operations only. The fact contradicts the real manufacturing process essentially. In the reality these operations are conducted simultaneously. Modeling of parallel appliances of various orders by one resource is not possible in that

kind of systems, what is in fact an ordinary situation for resources like transport or courses of methods.

The new basis structures offer the flexibility that is required. Flexible structures of the processes designed in the form of the operations network take place of the sequential execution of unique operations that used to be building as the hierarchy of production level. Various resources are able to be used by activities of many work orders together and simultaneously [5].

Simultaneously consideration of all the crucial resources is for achieving of the accurately planning outcomes a necessary condition. A work could be start only if the accessibility of all resources is good synchronized. As a result a material is being purchased on that time only.

Beside the material, workers and machinery there is in addition equipments for production purposes and surfaces as regards assembly, which have to be taken into consideration as well. Theoretically it makes no difference to APS system on how many various resources might be engaged. Optimization of using of resources is carried out according to diverge goals.

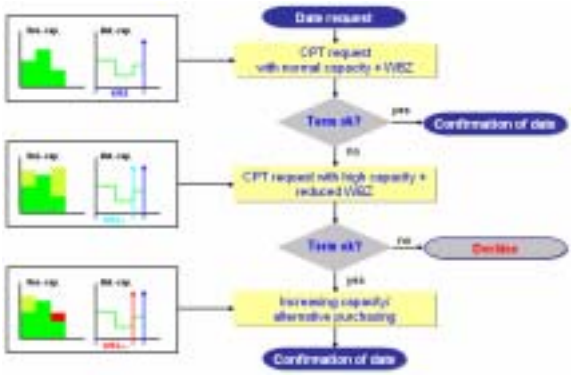

Fig. 2. *CTP request based on proALPHA® APS*
Source: self work based on [2]

Evaluation a specific delivery date for standard products is carried out on the basis of inward and outward stock movement supported by the Available-to-promise (ATP) method. Up to the date of delivery there are no planning orders on the client oriented environment. In that case, the scheduled delivery date must be set on quasi real-time, having regard to actual availability of resources and complex structures. This kind of examination of capability is known as capable-to-promise (CTP) method. Classic PPS/ERP systems cannot provide with a satisfactory solution for this problem.

The routine of CTP diagram is presented on the figure 2. If the requested delivery date cannot be met, it is possible to schedule under condition of capacity overload and/or shortened .replacement time for material. Capacity adjustment is the way to eliminate overload and the shortened replacement time is understood as the utilization of alternative suppliers [4].

2. EXAMPLE OF OPTIMIZATION

APS plans completely. Existing systems, including Manufacturing Execution Systems (MES), define routings to manufacture a component as a pre-defined sequence of operations. With APS we will be looking at order networks. The process of manufacturing a component does not have to be a sequence. APS uses the concept of multi-resource planning. That is, all the resources needed for the production of all orders over the entire planning horizon are taken into account. The different planning phases of MRP and MES are performed in one single planning step.

This sounds simple and logical but requires a complex and combined planning. All resources like employees, machines, tools, materials and transport equipment involved in one order within the planning horizon have to be assigned to that order and considered when planning all the steps of another order that is competing for the same resources. This results in a considerable decrease in “priority” orders. Even rush orders are processed in the normal production cycle without the panic [1].

The following example illustrates the function of optimization in proALPHA in a simple way [3]:

A work order is planned for the parts "Part A", "Part B" and "Part C" each. Each work order has three operations that are processed at different work stations (machines). Each work station (machine) has a capacity of 8 hours per day. Each operation, on the other hand, requires 8 hours. Planning the work orders in the sequence "Part A", "Part B" and "Part C" results in the following resource utilization. Hence, part A ends on day 3, part B and part C on day 4.

	Day 1	Day 2	Day 3	Day 4	Day 5
Machine 1	Part A	Part B			
Machine 2		Part C			
Machine 3		Part A	Part B		
Machine 4			Part C		
Machine 5			Part A	Part C	
Machine 6				Part B	

Optimizing the three work orders results in the following image:

	Day 1	Day 2	Day 3	Day 4	Day 5
Machine 1	Part B	Part A			
Machine 2	Part C				
Machine 3		Part B	Part A		
Machine 4		Part C			
Machine 5			Part C	Part A	
Machine 6			Part B		

Now, part B and part C end on day 3, while part A ends on day 4. What happened? Since the work orders have the same priorities and requested dates, two work orders end on the requested date (day 3). With optimization, two instead of one work order can be delivered on schedule. The priority for "Part A" can subsequently be increased. The higher priority in the delay results once again in the representation shown in the first image, i.e. the work order is complete again on day 3.

3. IMPLEMENTATION

Computing optimization is a basis of detailed planning and scheduling with multidimensional goals. This is a user, who decides about selection and parameterization of the objective function. Productive algorithms make the calculating time is very fast. The results can be viewed or edited with the graphic elements in the Gantt chart (fig.3).

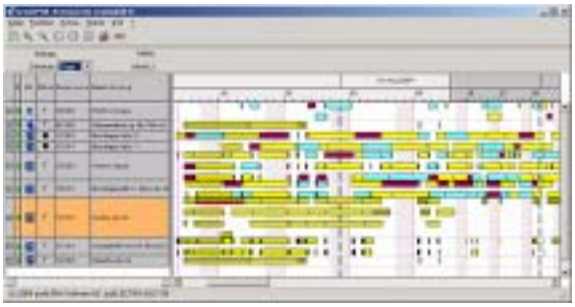

Fig. 3. *Gantt chart of processes*

Total value-added process can be managed directly in a work order specification. There is no constraint on viewing a real network structure, what used to be a serious problem for classic PPS systems. The unique operations of one sub-process, which are maintained simultaneously, could be trouble-free presented on the Gantt chart. Though, there is still a possibility to use the classical bill of materials and routines [4].

Sales and production managers find the ad-hoc information on promise dates to be most useful. The fact that the APS server holds the entire order network in memory enables every query to be answered rapidly and reliably after checking all resources for availability and reserving them for the expected order. This process includes all orders and all business processes- even the delivery date of required purchased parts is taken into account. Planning is done within order networks, not for production steps.

If the order cannot be completed within a desired period because one or more required resource is not available, the system will calculate the earliest delivery date possible. And, this date will be met! Humans not computers make the final decisions and the APS planner has different approaches at his disposal to resolve delivery issues. For example, put overtime in one manufacturing process and observe the influences it has on the entire production chain and all orders in progress. Now there is still a possibility to avoid that costly extra shift to complete an operation or that backlog of assembly components waiting for two days because of a capacity bottleneck [1].

SUMMARY

In many manufacturing companies, it is possible that employees have no overall view of the work orders to be manufactured and their demand-oriented and on-schedule finishing. For this reason, a system is necessary that provides this overview. proALPHA® is an example of solution which gives a system that provides an overview for the work orders as well as for the available resource and capacities. In the process, it gives the planner all the options for the control. The presented solution shows the user where corresponding bottlenecks occur and puts the planner in a position to counteract accordingly.

References

[1] *APS - Advanced Tools for Manufacturers*, News & Archiv, www.proalpha.com, Munich 2002.

[2] Grunow M., Günther H.-O., Viergutz B., *APS-System auf dem Prüfstand*, w: PPS Management 7, Berlin 2002, s. 27-30.

[3] Heitmann W., Distler A., *Presentation Script based on proELECTRO AG*, proALPHA Software AG, Weilerbach 2004.

[4] Kluge P.D., Kużdowicz P., Andracki S., *Multi-resource-planning and realtime-optimization based on proALPHA® APS solution*, Automation 2006, Warszawa2006.

[5] Viergutz B., Tuschinski R., *APS im Mittelstand. Innovative Ressourcenplanung bewährt in der Praxis*, Wydanie specjalne PPS Management 2/2004, GITO-Verlag, Berlin 2004.