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ADVANCED PLANNING SUBJECTS IN SCM

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ABSTRACT
Supply chain management (SCM) is the task of integrating organizational units along a SC and coordinating materials, information and financial flows in order to fulfil (ultimate) customer demands with the aim of improving competitiveness of the SC as a whole. The companies that combine mature planning processes with advanced planning systems gain added performance improvements. Planning orchestrates the flow of materials and resources, getting them to the right location at the right time, in the right sequence. Effective planning balances demand and supply, internal and external objectives, all in a constantly changing environment. Mastering supply chain planning can provide a major competitive advantage. In this paper the main subjects of advanced planning in the supply chain management will be discussed and key performance factors will be given for better performing in the competitive supply chain structure.
Keywords: advanced planning, supply chain management, advanced planning systems

1. INTRODUCTION

Supply Chain Management represents a new focus on how to link organizational units to best serve customer needs and to improve the competitiveness of a SC as a whole. In this purpose, with aid of many other disciplines like computer science, logistics, marketing, operation research, organizational theory, etc, planning and managing the SC is very complex. In these complex and hard subjects, every part of SC management needs some tools to give better and much more accurate decisions.[5]

Advanced Planning Systems are based on the principles of hierarchical planning and make extensive use of solution approaches known as mathematical programming and meta-heuristics. A hierarchical approach to planning helps on dividing the large and complex problems to more analysable and solvable sub-problems. It tries to resolve the complexity of the plan by levelling the manufacturing systems. The problem definitions are turned from complex monolithic models to hierarchical defined sub-problems.

2. ADVANCED PLANNING

2.1 Definition

Advanced Planning Systems (APS) can help in the integration of different aspects of decision-making. It is especially helpful in dynamic environements because it is connected to real-time MRPII / ERP systems and it facilitates frequent change in plans according to market and resource availability conditions. It is also benefical in that it facilitates the combination information of information at multiple sites and calculates an optimal plan accross the supply chain. [3]

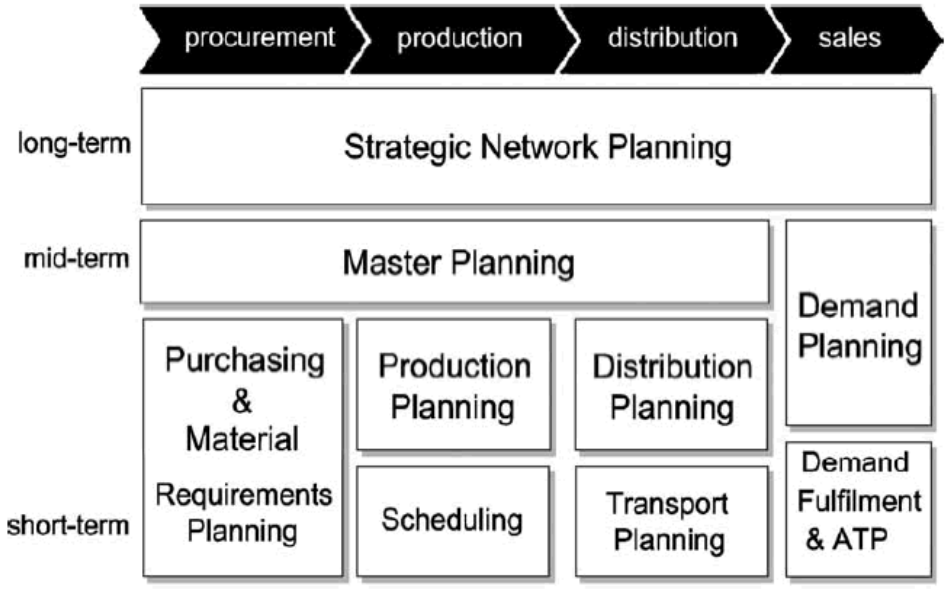

Figure 1. SC planning matrix [5]

The tasks in Figure 1. can be considered at different levels of aggregation and planning intervals ranging from "aggregated long term" to "detailed short term planning". The SC planning matrix in the figure 1 are planning tasks, which alsı correspond to general ERP software modules.

2.2 The Benefits of APS

- *More efficent and dynamic approach than MRPI/MRPII and ERP*: an ERP system works well in a manufacturing environement which is fairly static. Advanced planning can help the the integration of globally and highly distributed organizations to consolidate sophisticated information and database management
- *Geared towards business problems of today and future*: AP systems are supposed to function efficently in competitive market place, with short manufacturing lead times and tightly controlled inventories coupled with highly uncertain demand environement.
- *Concurrent demand, material and capacity planning*: Instead of planning these three subjects planning sequentially, they are considered simultaneously in advanced planning. This results in an integrated, synchronized and cohesive plan.
- *Better integration of strategic, tactical and operational planning levels*: AP systems helps enterprises to evaluate not only factory planning and scheduling but also current practices and plan for future operations at tactical and strategic levels.

3. MOST IMPORTANT SUBJECTS OF ADVANCED PLANNING

Strategic Network Planning: Formal strategic planning calls for an explicit written process for determining the firm's long-range objectives, the generation of a alternative strategies for achieving these objectives, the evaluation of these strategies, and a systematic procedure for monitoring results. Each of these steps of the planning process should be accompained by an explicit procedure for gaining commitment. [1]

Demand Planning: The process of demand planning can involve a number of different activities from data collection and statistical analysis to seeking feedback from customers and sales representatives and consensus buuilding accross different organizations. It is typically a closed loop process, initial or baseline forecasts are generated based on business experience and analysis of historical sales data, or by using statistical time series techniques. The baselines are then refined through collaboration with cutomers and other stakeholders within the business.

Master Production Planning and Scheduling: Master production planning and scheduling decides production volumes and timing for particular final products, according to customer demand. This is a short-to-medium term decision-making horizon. The quantity of each product determined relative to a combination of received customer orders and projected orders calculated by demand forecasting. Target resources in this level are similar to those for demand and supply planning; however the capacity limitation for a whole factory or particular area is based on constraint parameters rather than decision parameters. A schedule generated at this level is used to forge a kind of "contract" between the sales and manufacturing devisions. At the same time, all business activities are synchonized to this by confirming feasbility of the schedule according to their local capacity information. [4]

Aggregate Production Planning and Optimization: Aggregate production plan linear programming models can be made for different types of production combination. Simplest plan formulation is for single product single process production. If there are many products and many processes, the complexity increases greatly. Aggregate production plan for single product single process can be based on measuring aggregate sales forecast which comes generally from the marketing department and inventories in terms of direct labour hours.
Using linear programming provides short and comprehensible reports to top managers. Aggregate plans must be both easy and optimal. There are of course numerous software packages which are dedicated to solving linear programs (and other types of mathematical program), of which possibly LINDO, GAMS and XPRESS-MP are the most popular. All these packages tend to be DOS based and are intended for a specialist market which requires tools dedicated to solving linear programs. In recent years, however several standard business packages, such as spreadsheets, have started to include a linear programming solving options. The inclusion of a linear program solving capability into applications such as Excel is attractive for at least two reasons. Firstly Excel is perhaps the most popular spreadsheet used both in business and universities and as such is very accessible. Second is, the spreadsheet offers very convenient data and editing features which allows the user to gain a greater understanding to how to construct linear programs.

Distribution and Transport Planning (Supply Network Planning): Supply Network Planning integrates purchasing, manufacturing, distribution, and transportation so that comprehensive tactical planning and sourcing decisions can be simulated and implement on the basis of a single, global consistent model. Supply network planning uses advanced optimization techniques, based on constraints and penalties, to plan product flow along the supply chain. The results are optimal purchasing, production, and distribution decisions; reduced order fullfillment times and inventory levels; and improved customer service. Starting from a demand plan, supply network planning determines a permissible short- to medium-term plan for fulfilling the estimated sales volumes. This plan covers both the quantites that must be transported between two locations (for example, distribution center to customer or production plant to distribution center), and the quantities to be produced and procured. When making a recommendation, supply network planning compares all logistical activities to the available capacity. The deployment function determines how and when inventory should be deployed to distribution centers, customers, and vendor-managed inventory accounts. It produces optimized distribution plans based on constraints (such as transportation capacities) and business rules (such as minimum cost approach, or replenishment strategies). [2]

Optimization, solvers, algorithms and simulation : Solvers and advanced algorithms based on optimization models which mostly are built with deterministic simulations. The entire suite of supply chain planning modules provide support for deterministic simulation technology in optimization, scheduling forecasting and scenario analysis. Transactional simulations are done for scenario analysis. Various algorithms that have gone to support solvers are given in Figure 2. Discrete event based simulation is not explicitly used in advanced planning optimization (APO) . But the concepts are applied in deterministic framework for development of schedules in some of the algorithms. That is why advanced planning optimization delivers more deterministic results. Methods used in APO are [2]:

- Distribution planning is based on flow algorithms.
- Deployment functionality is based on branch and bound algorithms.

- Demand planning sub modules use exponential smoothing, heuristic and regression analysis methodologies.
- Production planning modules use linear programming and mixed integer linear programming.
- Detailed scheduling modules are based on genetic algorithm and simulated annealing based optimization technology.

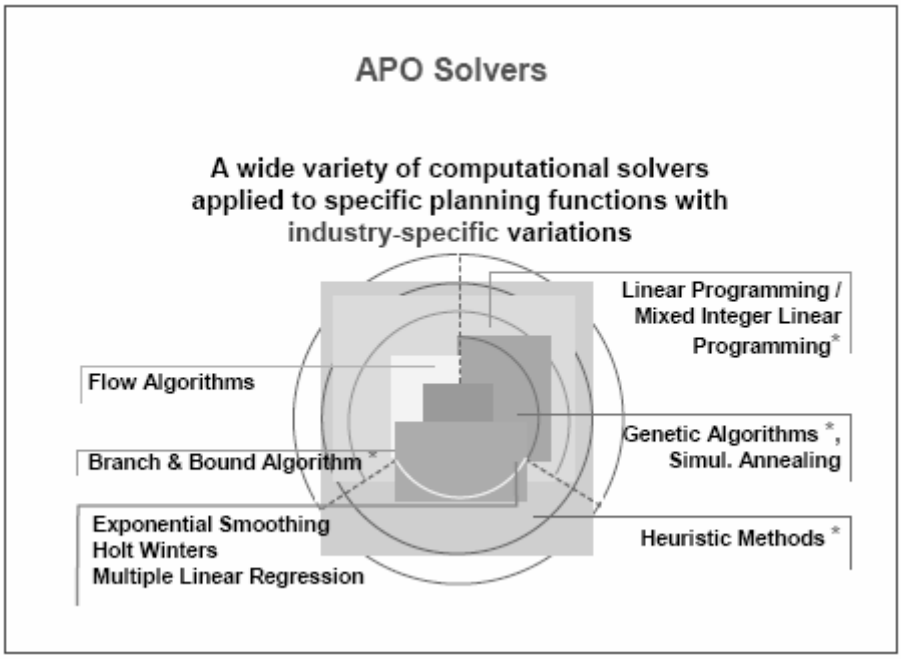

Figure 2. Optimization and solvers of APO[2]

A reason so many solvers are used is because there is not one algorithm which performs equally well for all class of problems. Thus simulated annealing which provides a better quality of solution is cpu intensive. So to solve this problem genetic algorithms can be used.

4. CONCLUSION

As a conclusion, one must know that the most needed and important issue in SCM is integration of these subjects above. Communication between organization hierarchies, an ERP software which satisfy the basic needs of SC network elements, real time electronic data interchange (RTEDI), education of workers are the key elements for achieving this goal.

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