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Parametric Determination of Inventory Management in SAP

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***Abstract*—In today's world, companies are having huge variety of inventories in stock. For each type of inventory held in stock planning has to be in order to achieve optimum utilization of resources. Doing this for each material individually is can be very tough task because of large numbers of materials held in stock by companies. So, there is a need of defining the inventory systems on a group basis. This research paper is defining the decision system which is allowing an automated inventory system design in SAP ERP. The SAP ERP corporate software package is the market leader for Enterprise Resource Planning systems, offering a wide range of inventory methods for the relevant inventory system modules. The advanced planning and scheduling system of SAP, Advanced Planning and Optimization (APO), provides additional inventory methods that can be chosen for the configuration in the inventory system modules.**

Keyword- ***Material resource planning, SAP ERP, inventory management, criterion definition***

I INTRODUCTION

Efficient material planning and control forms one of the most important factors in the industry. High amounts of money is invested by company in it, may add a substantial cost in a product, which highly affect the profit of company. Due to variety of products, companies often wide range of inventory in stock, which makes inventory control a tough task. There are various methods for efficient inventory control through corporate ERP software. SAP Germany, the world-market leader for corporate software, implemented methods for inventory control in their transaction system. The large amount of material held in warehouse and the there is a complexity of defining inventory planning and control system for an each and every single material is impossible. Because for that case thousands of inventory control systems have to be defined and maintained manually. Therefore, it is important to define an inventory control systems for inventory groups, which are formed on various parameters. Thus in present situation in company there is not an efficient material planning and control as group-wise planning does not account for individual requirements of materials regarding the configuration of the inventory control system.

The objective of this research is to highlight an automatic decision system which can help to define adequate inventory control systems for each material individually in stock, using the methods in SAP. The general present inventory control system will be analyzed and compared to the inventory control process implemented in SAP. There are various parameters which have to be defined for the SAP inventory control system. These include e.g.'MRP strategy', 'MRP procedure',' Safety stock planning' and 'Lot-sizing', For these parameters in SAP, implemented methods and decision systems are developed.

The criteria used for the decision systems of each parameter are mainly based on information stored in the SAP Material Master Data; the use of the criteria, decision systems developed for each parameter are discussed in this research paper. Finally, a conclusion is found.

II MRP PROCESS

In The process of material planning and control involves several planning steps. Following are the steps from general operations research perspective and then compared to the inventory planning and control process, which forms the basis for inventory planning and control in SAP.

The MRP process starts with generating the system's input data, which are the independent demands for all final products as well as all low-level materials with direct market demand (e.g. spare parts). The independent demands are generated in the Master Production Schedule (MPS). To determine the independent demands, either only customer orders are collected or customer orders and additional forecast values are added. Once the independent demands are planned in the MPS, the MRP procedure is launched [1]. For each material, starting from top in the BOM, the following steps are conducted.

A Net requirements calculation: Determine the net requirement by subtracting on hand inventory and outstanding orders from the gross requirement. The gross requirement equals the determined requirement from the MPS for the top level BOM materials and through BOM explosion for the lower level materials.

B Lot-sizing: Divide the net requirements in appropriate lot sizes for production or procurement.

C Time phasing: Determine start dates for production and order dates for procurement given the due dates of the net requirements and the lead times.

D BOM explosion: Use the start dates, lot sizes and the BOM to generate gross requirements of any required components at the next lower level.

E Iteration: Repeat these steps until all levels are processed.

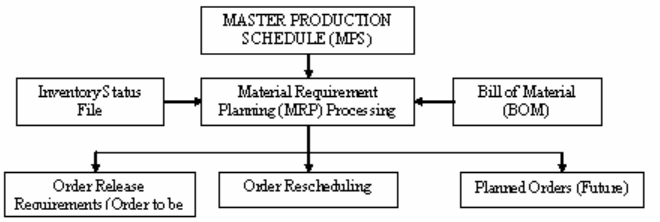

Figure1 MRP system

III MATERIAL PLANNING PROCESS IN SAP

Inventory planning and control in SAP can be conducted using the transaction based ERP software of SAP, SAP ERP or for more functions, the planning system SAP APO (now SAP SCM). When both systems are available, combinations of the modules in both systems can be used for the inventory planning as well. The following figure shows the inventory planning and control modules in SAP ERP and SAP APO; the systems can communicate with each other (data transfer) via the CIF (Core Interface) system [2].

The material planning process in SAP is very similar to the general MRP process as outlined in the previous section. The first step is the determination of the gross requirements for all BOM top level materials (Master Production Schedule).If consumption-based inventory planning is chosen then the gross requirements must be determined in the first step as well, disregarding their position in the BOM. In SAP, the gross requirements are determined by using forecasts and/or customer orders. The forecasts can be conducted in the SAP ERP module 'Flexible Planning' with 'Standard SOP' (Sales and Operations Planning) being a special method of 'Flexible Planning'; the forecasts are based on historic demand data, which is retrieved from the Logistics Information System (LIS) . In SAP APO the forecasts are conducted in the Demand Planning (DP) module, which draws the input data from the internal Business Warehouse (BW). This module offers a much wider range of methods and functionalities than SAP ERP does. The dependent demands, i.e. the customer orders, are recorded in the Sales and Distribution area of SAP ERP (as orders are transactions).Once the gross requirements are determined, a global Available-To-Promise (GATP) can be conducted in SAP APO on the sales order. The ATP function implemented in SAP ERP can do a single-level check, however SAP APO offers more functionalities such as multilevel ATP checks, ATP checks across the whole Supply Chain Network and rule-based checks; Another intermediate step between demand planning and the MRP run is to use the SNP (Supply Network Planning) module in SAP APO to assign and plan the independent demand requirements and already received sales orders to production plants Thus, the primary demand is allocated to a production plant or procurement (i.e. supplier).Now, for quantity planning, the MRP run can be conducted in the ERP MRP module.

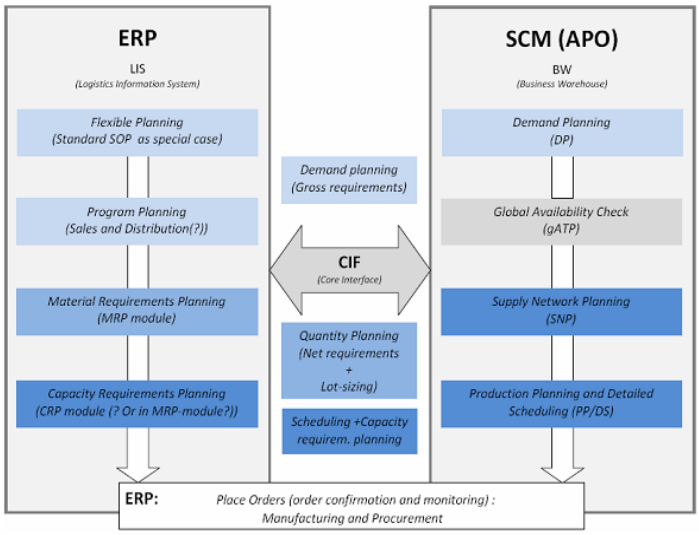

Figure 2: The Material Planning Process in SAP ERP and APO

Through BOM explosion the gross requirements are determined for all BOM levels; additionally lot-sizing and scheduling disregarding capacity restrictions can be conducted. The quantity planning can also be performed in SAP APO with additional functions. Scheduling and capacity requirements planning can be executed in SAP ERP [2]. Finally, order conversion and monitoring (processing of external procurement and manufacturing orders) is conducted, whereas orders for external procurements are executed in the SAP ERP module Materials Management (MM) which is in the Procurement area of SAP ERP, and orders for internal production are scheduled and monitored in the SAP ERP module Production Planning (PP) which is in the Production area of SAP ERP.

In the presented modules that make up the material planning process in SAP, several parameters have to be set for each material or material groups to allow for an adequate planning and cost-efficient material planning process

IV IMPORTANT PARAMETERS IN SAP IN MATERIAL PLANNING PROCESS

In the SAP material planning modules several parameters have to be set for each material or material group to design the material planning process. For each parameter setting there is a choice of numerous methods implemented in SAP ERP [3].Choosing the right parameter when running SAP as material planning and control system is the most important

part of material planning. Due to the high number of materials to be planned in a company, the high number of parameters to be set and the numerous methods that can be chosen for each parameter make the parameter setting a very difficult task [3]. In the following, five important parameters for the material planning process are presented and four of them will be considered for the development of automated decision systems for the parameters.

A Parameter: MRP strategy

In SAP the MRP strategy parameter for a single material or material group represents the basic structure about how the material planning process is conducted. It is very important to set this parameter in an economically sensible way. The main decision when setting this parameter is to decide about whether to use a customer-independent make-to-stock (MTS) planning strategy, meaning that production and procurement for all materials takes place before demand occurs. Choosing an MTS strategy affects the choice of the forecasting parameter as a forecast is needed for the market demand or possibly a make-to-order (MTO) planning strategy is selected with a sales-order-related production and procurement as orders are only submitted once market demand is observed, i.e. customer orders are received. Using an MTO strategy implies that no forecast is needed as material planning is only based on received customer orders. In practice, mixed strategies, combinations of MTS and MTO strategies are often applied.

B Parameter: MRP procedure

For the material planning process, it has to be decided which basic procedure in SAP shall be used. The MRP procedure (deterministic, plan-driven procedure) or the consumption-based procedure can be used. A special form of the MRP procedure is used by the Master Production Scheduling (MPS) procedure, where the first master schedule items are planned with special care in a first planning run to determine the MPS [4]. This generates the dependent requirements for the BOM levels directly under the MPS planning level. Material planning below these levels are not conducted in this planning run; once the MPS run is conducted, an MRP planning run is conducted for the planning of the remaining lower-level items. As can be seen, the right setting of the parameter MRP procedure highly depends on the setting of the MRP strategy parameter. There is a strong relationship between the production type (MTO, MTS and mixed strategies).

C Parameter: Demand planning and forecasting

Demand planning only takes place for the top-level materials of each BOM. Once the parameters for MRP strategy and MRP procedure are set, it can be determined from these parameters demand planning can be conducted for each material [5]. The main concern of the Demand Planning and Forecasting parameter is the choice of an adequate forecast method.

D Parameter: Safety stock

Safety stock planning is an important part of material planning when variability in terms of demand variability occurs. In SAP-ERP, dynamic (time dependent) and static (time independent) safety stock procedures can be chosen. Further, the methods can be divided into time-range of coverage methods and order cycle period methods and combinations of these. There is a strong relationship between the safety stock and the lot-sizing parameter and both parameters have critical impacts on the inventory costs.

E Parameter: Lot-sizing:

Once the net requirements, including the safety stock, are determined for a material, the net requirement will be split into lots. In SAP, numerous methods for lot-sizing are available. These can be divided into static lot-sizing methods, periodic lot-sizing methods and cost optimizing lot-sizing methods. The presented parameters include the most important decision areas in the material planning, such as MTS versus MTO, safety stock and lot-sizing.

V DECISION SYSTEMS FOR MATERIAL PLANNING PARAMETERS

In the following decision systems are presented that allow an automatic selection of methods for each parameter [6]. The decision system for the MRP strategies available in SAP ERP and SAP APO. Four main decision levels have been identified:

A Production type: The principal decision of the MRP strategy is the choice of the production type; in SAP it can be chosen from the five types MTO (Make-To-Order), MTS (Make-To-Stock), ATO (Assemble-To-Order), ETO (Engineer-To-Order) and STO (Service-To-Order). This strategic decision about how to plan the material is usually derived from the nature of the industry. The production type is an important criterion in inventory management.

B Product type: The decision system differentiates several product types such as customer specific products, general final products, assemblies and phantom assemblies, components.

C Planning configurable materials: There are three basic types of planning for configurable materials offered in SAP: material variant, characteristics pre-planning and configurable material.

The principle criterion for the choice of MRP strategy is the ‘production type’ that is used. Further, the ‘product type’ as a criterion gives important parameter for the strategic material planning decisions. The choice of an adequate MRP strategy is crucial for an efficient material planning process.

VI RELATIONSHIPS OF THE DECISION SYSTEMS AND OVERVIEW OF DECISION CRITERIA

In the decision systems for the four material planning parameters various criteria are used. Some of the criteria are used in combination with each other for a decision in the system. Some of the criteria are ABC, XYZ and LMN (large,

medium and small volume item) analysis as well as inventory cost factors such as holding cost and order cost.

The decision system for the MRP procedure parameter is very complex system. While assuring a high service level, the safety stock and lot sizing parameter, leads to minimize inventory costs. The ABC- and LMN-analysis are therefore important criteria in the decision system. The lot-sizing decision system directly relates to the order and holding costs [7]. The safety stock parameter helps to get determined service level. Both parameters have to be configured given the detailed material planning process designed by the two preceding parameters, showing their high dependency on these two parameters. The safety stock and lot-sizing parameters follow similar goals and hence, are similar in structure and criteria used; the dependencies between these two parameters, however, are limited

A Implementation of the Decision System in SAP ERP/APO

Before planning an implementation of the decision systems in SAP, these systems should be tested in order to assure that adequate material planning systems for a wide range of different materials. The additional information cost incurred by providing the necessary input data for the decision systems needs to be evaluated and compared to the cost savings of having an automatic material planning systems [8]. A lot of information has to be stored and maintained in the Material Master for the decision systems to work.

Some of the 8 compulsory data entries are usually already maintained in SAP, such as 'value per unit', 'historical demand', 'historical lead times' or at least an estimate of the average lead time, and the BOM. Further, some of the optional data entries are usually maintained in SAP as well, such as 'lot size restrictions', 'order cost', 'inventory holding cost' and 'delivery schedule'. Thus, the additional data requirements needed for applying the decision systems might cause limited effort.

The implementation of the decision systems in SAP ERP can be a good solution for the everyday business. In order to reduce the required effort of an implementation, the decision systems can also be implemented individually. This leads to less work and cost and allow the use of the decision system for the parameters in which the help is needed to the material planners [9].

VII CONCLUSIONS AND FURTHER RESEARCH SCOPE

The developed decision systems for the determination of the MRP strategy, MRP procedure, safety stock and lot size parameters in SAP ERP results in saving cost and the time of the material planner. Further, the systems are the first to categorize the available methods implemented in SAP ERP for each parameter; the decision systems gives valuable guidelines about which inventory methods are implemented. The implementation of the systems can be flexible as they can be applied independently from each other, and several decision steps within each system could be excluded and left for manual configuration to reduce implementation and data maintenance efforts.

Next steps of this research can be to implement the decision systems in a software tool and run tests on empirical/fictitious data. Considering inventories and whole supply chains can show if the configuration systems deliver adequate configurations of the parameters. Further, the implemented inventory methods in SAP ERP can be examined to identify missing methods or areas with potential improvement.

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