WEB-BASED IMPLEMENTATION OF REPLENISHMENT PROCESS IN DISTRIBUTION CHANNELS - A CASE STUDY

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Demand-driven replenishment moves organizations away from a dependence on forecasts based on retrospective data and enables them to become responsive to what is actually occurring, or predicted to occur, at the distribution channels. In order to respond rapidly to demand changes, the institution of better information systems to help the channel better align inventory holding with demand is important. This case study explores working practices of procurement in distribution channels and examines the role of better demand information and retail inventory in enabling better control in retail behavior. The solution proposed in this paper is a knowledge system which provides the decision maker with better characteristics of distribution channels such as quick response, efficient inventory management, collaborative planning and forecasting.

Significance: The objective of this paper is to present a new automated business solution for support of replenishment and forecasting in order to eliminate problems of manual replenishment for n distributors using Internet technologies.

Keywords: Inventory replenishment, distribution channels, Internet technologies, XML.

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1. INTRODUCTION

World economic crises forces companies to reduce costs. In the current situation a big issue is how to improve business processes with minimal engagement of human and financial resources. We observed distribution channels that are influenced larger by the type and size of the business. Key processes in distribution channels are inventory management, procurement and sale forecasting.

While the need for holding inventory can simply arise due to the time required for physical delivery of the good at the retail location, in many channels uncertainty about demand at the time of the contract can also be an important factor. If demand is uncertain, then the inability to forecast demand accurately can result in a mismatch between the inventory that is held by the retailer and the realized demand.

Production company can organize sales of their products in a few different ways: through their own sales department without delivery, with their own sales and product distribution at the same time, by outsourcing distributors that will do sales and delivery, by Internet sales with outsourced delivery etc. Supply chain in this case links production company, distributor and retail stores (customers). Procurement management takes together process of managing inventories of each distributor, through inventory control, launching orders and organization of delivery.

The problem of filling in inventories of few distributors can be solved by implementation of clear procedures with the use of different software packages that have developed modules for inventory management, stocks, distribution, sales etc. Optimization of ordering problem in the given business model is analyzed through automatization of activities of orders preparation, analysis of available inventory and delivery organization. Automatization of presented activities is possible through the implementation of software solutions as: SAP, CRS (Continuous Replenishment Software) or other ERP solutions (mostly based on VM1 (Vendor Managed Inventory) principle) or by manual work with the use of widely spread Microsoft packages (mostly Excel Spreadsheets). By looking to available solutions for the automatization of ordering process, from manual processes to automatic ordering, from retrospective view, key characteristics are presented that enable functioning of the ordering process with different levels of automatization and complexity.

Potential solution is CRS which functions on the principle of movable time periods. Functioning of this solution is based on the following activities: once a week data about inventory level for each product in the region is entered, system automatically generates missing quantities data based on defined levels of min/max inventory, then forms optimal critical mass for delivery of the full truck, automatically sends report on delivery prepared for the region. After entering the inventory status of distributor (for the observed region), system automatically considers necessary quantities per each product, taking into consideration quantities that are „in flow” which means in the transportation process or waiting for the certain distributor.
Huge number of small regions, i.e. huge number of distributors at the local markets in the region, is a drawback for implementation of CRS system that views the whole region as one objects whose inventory is managed. Basic conditions for functioning of CRS software are:

- One number that represents inventory status of one product in the certain period of time.
- One number that represents min/max level of inventory for one product.
- One distributor that supplies the whole region.

Presented conditions for implementation of CRS for the mentioned region are not possible from the following reasons:

- Region is composed of 5 sub-regions, because of smaller quantities of sales (low profit) that does not justify automatization i.e. making of new regions i.e. increasing complexity of system that does not make bigger profit.
- Each of the regions consists of 1 or 2 distributors in the frame of region.
- Region in total counts 7 distributors, which represents more than one distributor (constraint in SAP implementation) that presents inventories for 1 product, i.e. more than one level of min/max inventory for 1 product.

SAP order management process as well presents potential solution in the automatization of ordering system for distributors. Inventory management in SAP environment functions according to the system for ordering for inventories, opposite to the ordering for a certain time period. By forming min/max level of inventories, based on the analysis of sales forecasting for certain time period, foundation of automatic generation of quantities required is created and automatic sending of orders in regional distribution centre is enabled. Implementation of SAP and module Order management process demands fulfillment of numerous preconditions: ownership of own capacities integrated in SAP (through Inventory management system module), automatization of inventory management based on the model of ordering inventories, opposite to the current ordering done by distributor (SAP Solutions, 2009).

By considering current business model of supplies in the given region it is possible with certain modifications to enable implementation of SAP (in the case of financial justification in the region). In the case of increased sales SAP system has possibility to enable functioning of ordering for n-distributors. Solution is based on model in which each distributor is considered as the separate customer, which does not require engagement of their own sales forces, but investments in the local central warehouse, from where goods would be delivered to distributors. In that case, of course, reasonableness of inventories is considered again, warehouse space, working force and etc.

Other software packages that have possibilities for inventory management are as well based on the principle of VMI. VMI situation requires management on the „one-number“ principle, at the overview of inventory levels, and definition of min and max level of stocks. VMI principle is based on full responsibility of suppliers for inventory management, in the name of distributors.

Cost-benefit analysis of described solutions of automatization of ordering process currently does not show results that create conditions for implementation of highly automatized system of ordering in the case of the observed region. Costs of implementation do not match expected profit, expected sales and profit gained. By detailed analysis it is estimated that observed region records increase in sales, but not in the way that proves implementation in the period (in the next 5 years) taken into consideration in the feasibility study.

Those facts make possibilities for development of model that enables automatization of ordering process for distributors. There are five sections in this paper. In the first section overview of inventory management in distribution channels and overview of related work are presented. The second section presents short overview of inventory management in distribution channels. Current working practice in replenishment within distribution network, identification of problem and demands fulfillment of numerous preconditions: ownership of own capacities integrated in SAP (through Inventory management system module), automatization of inventory management based on the model of ordering inventories, opposite to the current ordering done by distributor (SAP Solutions, 2009).

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2. INVENTORY MANAGEMENT IN DISTRIBUTION CHANNELS

Inventory presents sum of resource units that a company needs for execution of basic processes in value creation for customers. Inventory management systems present group of procedures by which activities of inventory level control are executed, forecasted inventory levels are defined, time for renewal of inventory is defined, then ordering, size of series/quantities for ordering etc.

Main concept of inventory management is based on definition of two key parameters: when is time to renew inventories and what amount of products to acquire. Inventory management is based on the decision about harmonization of demand and supply i.e. of taking certain activities with an aim to balance required and available quantities for the market. From the distributors point of view, the aim of inventory management can be described through following activities: (1) enabling optimal levels of inventories at distributors’ warehouses in desirable time periods, (2) identification of current and future requirements (plans) for products of all kind at the inventories, (3) management of costs directly linked with inventories (costs of keeping regular inventories, costs of assured inventories, economic approach by ordering bigger quantities, costs of values of quantity supplied, anticipation of cost changes, protection of inventories, costs of customs and different types of taxes, manipulations and inventories, etc).
With an aim to establish Good Inventory Management Practice in a production company, it is necessary to identify and manage following parameters: implementation of continuous or periodical control and monitoring system of inventories, forecasting of demand with available and relevant information, together with cost optimization of: keeping inventories, ordering, lack of inventories, delivery times, assurance of optimal level of inventories in warehouses and production processes, calculation of taxes and costs of inventories assurance, ordering and costs of “regulation of” inventories, costs of keeping product units on inventories, costs of transportation and trans-shipment, costs of receiving and quality and quantity control of goods delivered, costs of manipulation in inventory, cost of putting on and off the warehouse, costs of inventories such as identification of inventories, providing and keeping temperature wanted, costs of amortization of warehouses and equipment in warehouses, costs of outdating of goods at the warehouses, etc.

Models for inventory management can be classified into Single-period inventory system and Multi-period inventory systems. There are two general groups in Multi-period inventory systems: Fixed order quantity models (as well known as Model of Economic Order Quantity EOQ, Q models) and Fixed time period models (different models as periodical system, periodic review system, model of fix ordering intervals i.e. P models). Applied models of inventory management define functional connection between key variables and effectiveness measures, by using costs of inventory management as important index of model efficiency.

3. REAL-LIFE EXAMPLE

The analysis here focuses on the distribution channels between multinational companies and distributors at the local market. Multinational company has production plants dislocated in the EU countries with centralized warehouse of finished goods where from South-Eastern Europe market is supplied. Business model is based on the engagement of local distributors, with partly automatic process of ordering and forecasting. Current supply model with few distributors, supplied with products from regional distribution centre shows certain short-comings.

3.1 Current Working Practice in Replenishment within Distribution Network

$N$ distributors procurement model presents a supply chain in which three supply objects are connected with material flows: production company, regional distribution centre and distributor. By observing information flows required for supply chain functioning, five objects are identified in the business model:

- Production companies – production companies are dislocated production plants located in the four different countries in the EU.
- Regional distribution centre – presents centralized warehouse of goods for the regions of Central Europe (CE) and South-Eastern Europe (SEE), in this warehouse finished goods are delivered from the production plants in EU. Just as well, regional distribution centre disposes with inventories for supply of all local CE and SEE markets.
- Regional procurement office – it is a regional team for supplies located in the regional distribution centre. Regional team is responsible for the communication with local CE and SEE markets, through activities of checking data received from local regions, processing of orders, forming and organization of deliveries by using information system (SAP).
- Local procurement office – it is a local team located in the observed region. Local team is responsible for the communication with distributors in the region, taking orders from distributors, forwarding orders to regional procurement team, coordination of deliveries, control of reliability of supply chain in local region, forecasting of sales/orders of distributors for the following month.
- Distributors – “sales through distributors” is a business model where distributors are importers of the whole product portfolio in certain country; they deal with customs issues, organize sales channels, and execute sales and distribution to a defined segment market.

Functioning of ordering process require clear and on-time communication of all participants in the supply chain. Basic IT skills, Internet connection, reliability of available information and meeting defined deadlines, are basic conditions for each channel member, so to enable process to go on. Process of supply of distributors in the current business model (Figure 1.) is based on 12 activities (repeated every 7 days):

1. Distributor sends report on current inventory level in its warehouse to the local procurement team (Excel XLS file format).
2. Distributor creates order of goods to be supplied next week (XLS file format).
3. Distributor sends XLS file order by e-mail to the address of the local procurement team.
4. Received orders of all distributors are forwarded by local team to the regional procurement team, each Wednesday until 12pm (in separate XLS worksheet, name of distributor has to be marked on the order).
5. Regional procurement team collects all orders (from CE and SEE regions) and sends them to a regional distribution centre, each Wednesday, by 6pm.
6. Regional distribution centre analyze available inventories and quantities ordered, and creates a desirable plan of inventories for the beginning of the next week (70% of all products for CE and SEE markets are produced in the production plants at the location of the regional distribution centre, 30% is produced in EU and it takes 24 hours for them to be delivered, so it can be presumed that period need for transport of products in the distribution centre does not effect the availability of inventories for supplying distributors). Based on the desirable plan of inventories, production plan is prepared for the following week.
Web-based Replenishment Process

7. Analysis of available inventories and predicted production in the following week (based on the production plan) enables information if it is possible to meet requirements for all demands in the next 7 days of the production cycle.

8. In the case of availability of inventories to meet requirements of all orders received, deliveries are organized for Monday or Tuesday next week, and regional team is informed about it (they pass information to the local procurement team).

9. Execution of production plan starts on Monday, regional distribution centre receives plan of finishing production for each product, based on the plan of production shipping plan is prepared for the rest of the week (Wednesday, Thursday, Friday).

10. Based on the information from the regional distribution centre, regional distribution team for procurement makes the final plan of shipping. Tuesdays until 12pm regional team sends information to the local team about the available quantities for all orders and with the planned time for shipping.

11. If available and planned production until the end of the week can not meet order (shipment <95% of ordered quantities), shipping is delayed for the following week and order is repeated for the missing quantities of the products based on the original order.

12. Local procurement team confirms the time of shipment to the regional team and forwards the info to all distributors.

3.2 Problem Identification

Current process of ordering for n distributors uses Excel tables for the formulation of orders, sending orders from distributors, sending feedback about distributed quantities and reports on final composition of order. Weaknesses of the current way of functioning of ordering for distributors are identified through inaccurate orders of distributors, unadjusted with demands of local i.e. regional team for procurement. Orders of distributor are basic information that influences the whole week cycle of orders. Orders often contain not updated titles of products, wrong EAN codes of products, different measurement units of products etc; it is just the top of the ice for the problem that these mistakes cause in the forecasting and ordering process.

Mistakes in the orders indicate few problems: (1) creation of procurement plans (different codes of planned and ordered products, different measurement units, ordering of old, non active products etc, (2) creation of production plans (plan of production demands quantities to be given in the same measurement units, old codes makes confusion in the production of active products) and (3) creation of documentation that follows delivery of products to distributors (wrong code of the products causes different price of the product, different ways of packaging, errors in shipping list etc).

With an aim to avoid mistakes in orders, current business practice demands certain number of manual activities and time for update titles, codes, quantities, format of Excel tables etc. Order in XL S file should match the form that enables undisturbed connection and data transfer from the order to the SAP System application (on which the whole business of the regional centre is based, just as the system of production planning and inventory management. Manual work is necessary in the following cases:

• Distributor manually fills in order in a given Excel table (not taking care about formats of rows and columns, validity of EAN codes, etc).
• Local procurement team processes the distributor’s order, by checking input values, row format, codes, EAN codes, titles of the products, etc.
• Regional procurement team re-transforms the order received with an aim to define matrix format in Excel table, that is compatible with the SAP system format for the input of orders (if employee estimates that Excel table deviates from SAP requirements, manual entering into system has to be done).
• SAP automatically adds available inventories for each order.
• Regional procurement team (based on the added quantities of the products), manually enters given values in the Excel table that is modified comparing to the first given order, by adjusting rows of XLS order through the process of optimization of quantities for forming full truck for delivery, with an aim to identify deviation between ordered and quantities ready to be delivered.
• Local procurement team transfers values from XLS given by regional team in the order that is at first received from distributor, so to present clearly to distributor which products and in which quantities are ready for delivery (by writing it down next to the ordered amounts, so that the difference is clearly visible: ordered & ready for delivery).

3.3 Proposed Solution

The idea of the improvement of ordering process is based on the forming of one virtual distributor that takes the role of a few real distributors. Virtual distributor has the basic role in summarizing information gained from the real distributors in one number (sum of current inventory, sum of ordered amounts, and sum of executed sales). Figure 2. shows new architecture of the system for ordering support, forecasting and product distribution.
In order to avoid all problems mentioned it is suggested to introduce lite version of the information system that is based on the listed components:
Web-based Replenishment Process

- Web application for inventory that works under the adequate database (Inventory DB). This Web application is used by distributors who have to have computer with Web browser and Internet connection in order to be able to use the application. Basic functionality that application shows is keeping inventory status for each distributor. Distributors enter on daily basis the quantities of the products sold. On the other side, based on the given approved quantities in XML format, database is automatically updated. Application should offer support as well for creation of orders for each distributor.

- Forecast Agent is module that is used for forecasting of needs of distributors through the analysis of sales in the previous period of time and on defined business rules (Business Rules database).

- Notification Agent is a module that is in charge for notification and announcement of each distributor on approved quantities of products that will be delivered in the next period. Notification can be done in few different ways, and the most suitable is notification by e-mail and notification published on Inventory Web Application Main page.

In the architecture like this, local office creates orders for each distributor by using Inventory applications. Orders are sent directly to regional centre in the XML format that is in the line with the adequate XML schema.

The order in XML format is ready for automatic import to SAP system of the regional distribution centre. Forecast, which are responsibility of Forecast Agent, are as well sent in XML format in the line with agreed XML schema. Feedback from regional centre is also sent in XML format that is ready to be automatically imported into the information system of the local office.

Based on the document Approved contingent quantity per distributor, Notification Agent sends notification to each distributor about approved quantities of products so that they can prepare for reception and warehousing of goods.

We have to mention that planning and implementation of this mini information system would not be expensive or difficult, and it would demand 6 months of work with smaller group of programmers.

The advantages of this architecture are:

- Distributor does not have to fill in order. Instead of submitting orders, information system of the local office takes over the task of preparation and on-time order sending.

- Distributor input quantities of sold products on daily basis according to types of products which with inventory status at distributor is updated on the daily basis and visible from local IS office.

- Local office has no longer obligation of checking orders of distributors, by checking input values, cell formats, codes, titles, etc.

- If any type of change occurs in table of codes at the regional level (SAP system), changes are sent in XML format to the local offices that imports them it in there is.

- Regional office receives order in XML format that is adjusted with certain XML schema. Order in XML format is ready to be automatically imported in SAP system of the regional distribution centre.

- Forecast agent takes over care for forecasting for distributor through sales analysis in the previous period and based on the defined business rules.

- Mechanism of notification is introduced which with all participants are informed about approved quantities that will be delivered.

4. CONCLUSION

In this paper current solution of supply model of a few distributors is presented and problems identified in functioning of process of managing distributors’ inventories. Presented business models are partly automatized by the use of MS Office tools in a way that efficiency is improved. Current level of automatization, besides enabling execution of replenishment for distributors, causes as well certain problems. Identified problems in information flows (although they are not a drawback in the organizational functioning of the model) are drawbacks in achievement of excellence in doing business by causing certain problems in operative efficiency.

Improvement of process efficiency is possible by implementation of advanced ERP solutions in the functioning of the local office for distributors supplying. Use of ERP solutions would enable total integration with ERP solution in regional distribution centre. Company development strategy in the observed region does not justify significant costs for implementation of ERP solutions ie for development of information support to local procurement office. Alternative solution for improvement of supply of distributors is development of software module, based on components for inventory management, procurement and sales forecasting. Proposed software module will be fully interoperable in existing SAP ERP in regional supply office, based on the using of XML formats which is de-facto standard in application to application information exchange. It is estimated that costs of development of presented software module do not require significant engagement of resources in the implementation, either human or financial resources.
5. REFERENCES


BIOGRAPHICAL SKETCH

Danica Lecic-Cvetkovic is assistant professor of Production and services management and e-manufacturing at Department of Operational management, Faculty of Organizational Sciences, University of Belgrade. She acquired her M.S. and Ph.D. degrees in e-manufacturing at the same Faculty. She has published more than 50 papers in journals and conference proceedings, published in international and national journals and conferences. Her main research interests include application of information and Internet technologies in production and services management systems, ERP software and XML-based interoperability. She is member and leader of MESA group for Serbia.

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