IMPACTS OF VENDOR MANAGED INVENTORY ON BUSINESS PROCESSES - DEMONSTRATION AND PROCESS REFERENCE MODELING

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ABSTRACT

In order to improve their inventory management a growing number of *SME*'s plan to implement *Vendor Managed Inventory (VMI)* with supply chain partners. This means, they have to coordinate their business processes with their partners. The impact of *VMI* on business processes is frequently underestimated and hence the implementation of *VMI* fails. However, the use of process reference models for implementing *VMI* can lead to successful implementation as they offer best practice processes, which support the adoption of processes to a supply chain concept. An example for that is *LogWIN-P*, which has a high level of detail and is easily adaptable to processes of companies of different sizes and industries. The *LogWIN-P* model was extended to provide support for *VMI* implementation. This model thus describes the *VMI* process and shows the impacts of *VMI* on company's business processes and points out the required process-modifications.

Keywords: Vendor Managed Inventory, Business Process, Process Reference Model, Supply Chain Concept

1. INTRODUCTION

Due to globalization companies are doing business with partners all over the world to meet the needs of the end-user. Consequently, the companies develop closer cross-organizational relationships with their suppliers and customers and realize collaborative supply chain concepts like *Vendor Managed Inventory (VMI)*.

For the supplier *VMI* can reduce demand uncertainties for the production planning and improve forecasting. For the customer it ensures the availability of goods in the warehouse and reduced inventory and costs. Consequently, *VMI* improves the performance of the supply chain (Fisher 1997, Whipple and Russell 2007, Bernstein, Chen, and Federgruen 2006, Werner 2008, Schulte 2009).

However, the adoption rate of *VMI* is not as high as these associated benefits may lead us to expect, as a longitudinal study by the *Upper Austria University of Applied Sciences* in *Steyr* and the *Upper Austrian Chamber of Commerce* with 168 small, medium and large companies of the sectors trade and commerce, industry, information and consulting and transportation, showed (Humpl and Starkl 2009).

The study revealed that nearly half of the companies consider supply chain concepts (*VMI, Cross Docking, Just-in-Time*) as well as warehouse and identification technologies (*WMS, RFID, Barcode*) as important or very important for their business. However, only one fifth of the surveyed companies plan, optimize, coordinate and implement processes with their suppliers. Especially small and medium enterprises (*SME*) do not or only rarely coordinate and cooperate with partners. *SMEs* have to close this gap by developing knowledge about these concepts and evaluating their potential benefits.

It is especially difficult for small and medium enterprises to estimate the potential of *VMI*. They do not know which business processes are affected by *VMI* and how to integrate this concept into their business reasonably and successfully (Niranjan, Wagner, and Thakur-Weigodl 2011).

To support the implementation of *VMI* a best practice process model is needed, which helps companies to estimate the effects on their current processes, shows the required process-modifications and points out the differences to the conventional processes without *VMI*.

Therefore, an enhanced process reference model concerning *VM*I was developed which is based on the existing standard reference model *LogWIN-P* (Ortner, Rothböck, Stüger, Unterbrunner, and Wallner 2005) and is called extended-*LogWIN-P_VMI*. Hence *LogWIN-P_VMI* offers a good foundation and support for implementing *VMI* and shows the advantages of redesigning business operations.

The remainder of this paper is structured as follows: In chapter 2 we discuss related work by describing different versions of *VM*I and the use of process reference models. In chapter 3 we introduce the research methodology that includes a literature study and an empirical part. In Chapter 4 we describe the impacts of *VMI* on business processes and the differences to the product and information flow of a traditional individual order. Finally, we draw conclusions and point out our plans for future work.

2. RELATED WORK

Since in this paper we introduce a process reference model that shows the differences of traditional processes to *VMI*, this section presents *VMI* (2.1) and provides an overview of existing process reference models (2.2).

2.1. Vendor Managed Inventory (VMI)

VMI is a *Supply Chain Management* concept that is part of *Efficient Replenishment*, which aims at replenishing the goods continuously. *Efficient Replenishment* belongs to *Efficient Consumer Response (ECR)*, which focuses on collaboration of supply chain partners to satisfy customer needs (Arnold, Kuhn, and Furmans 2008, Hieber 2002). *VMI* assumes that the vendor takes over the responsibility for directly and independently replenishing the inventory of its customers without waiting for replenishment orders (Wannenwetsch 2010, Mentzer 2001).

Beside *VMI* the three cooperation concepts *Buyer Managed Inventory (BMI), Co-Managed Inventory (CMI)* and *Supplier Managed Inventory (SMI)* also belong to *Efficient Replenishment* (Arnold, Kuhn, and Furmans 2008, Wannenwetsch 2010).

As the four forms of *Efficient Replenishment (VMI, BMI, CMI* and *SMI)* are often used synonymously, we further use the term *Vendor Managed Inventory* for all three concepts.

Primarily all *Efficient Replenishment* concepts are characterized by close relationships (Alicke 2005) between the supply chain partners and aim at creating benefits for all partners such as (Kuhn and Hellingrath 2002, Mentzer 2001, Arnold, Kuhn, and Furmans 2008)

- reduction of transaction costs,
- optimized and integrated inventory management and reduction of inventories,
- efficient, value added and lean processes,
- enabled expeditious and flexible reaction on occurring demand modifications,
- competitive capability,
- reduced uncertainties concerning customer requirements and
- increased supply and service rate.

Concerning the successful implementation of *VMI* the *ETH Zurich* developed a checklist to assess the readiness of companies for *VMI* (Niranjan, Wagner, and Thakur-Weigodl 2011). But this checklist does not provide information which process modifications need to be done when implementing *VMI*. Best practice processes of a reference model can close this gap and support a successful realization of *VMI* (Becker, Kugeler, and Rosemann 2005).

2.2. Process Reference Models

Reference models are a composition of approved best practice processes and theoretical knowledge about business processes that can be used as guidance models by companies for modeling their own business processes (Becker and Delfmann 2004, Schulte 2009).

These reference models are characterized by various properties. Hinkelmann (2008) states that reference models illustrate structures, properties, relations and behavior of objects of a specific application domain in a generally accepted and applicable form. Consequently they (Becker and Delfmann 2004, Schulte 2009, Corsten and Gössinger 2001, Nikodemus 2005)

- serve as guidelines,
- are generally accepted,
- provide a basis for further development of company-specific models,
- are used as an analysis and optimization tool (i.e. weak-point analysis) and
- are used for optimization of existing models.

To provide these capabilities reference models have to fulfill high requirements. They should not be too general, because they would not provide enough guidance for the development of company-specific implementations of these processes. On the other hand they should not be too precise either, as they have to be applicable for different situations and companies. In addition, they must not be influenced by market changes which ocurr or other external influences, but have to be flexible, as they must be individually adaptable and expandable (Schulte 2009).

Especially for the area of *Supply Chain Management* the *Supply Chain Operations Reference (SCOR)* model was developed by the *Supply Chain Council (SCC)*. It is a reference model which is based on a framework that links business processes, best practices and technology features and aims at reproducing the supply chain in a transparent way. Generally, reference models of various areas and for different purposes are existing, such as *ITIL* or *SAP*, but for the area of Supply Chain Management *SCOR* is very famous and aims at implementing state-of-the art systems and practices (Supply Chain Council Inc. 2010).

Another process reference model in the area of *Supply Chain Management* is *LogWIN-P,* which was developed by the research institution *Logistikum* of the *University of Applied Sciences* in *Steyr/Austria*. It is an intersectoral model which is applicable for any industrial company and gives a current description of process steps and interfaces in great detail (Ortner, Rothböck, Stüger, Unterbrunner, and Wallner 2005).

3. METHODOLOGY

In order to develop an extended reference model, a multi-staged approach was chosen. In a first step a comprehensive literature review concerning the topics *VMI*, process management and process reference models was conducted. This included bibliographies, journals and the digital data bases *EBSCO*, *Emerald Management Xtra*, *IEEE Xplore*, *ISI Web of knowledge* and *WISO*.

Concerning the subject area *VMI*, the literature review was based on the notes *Vendor Managed Inventory, VMI, Supply Chain, Supply Chain Management, Logistical Concepts, Logistics, Network, Cooperation or Collaboration*. The search for process management and process reference models was based on the notes *process management, process reference* *models, processes, SCOR, Logistics processes, process modeling, process design* or *process optimization*. Overall, 48 bibliographies and 72 journals were reviewed. Out of them, relevant literature was selected concerning the connection to *VMI* and processes, which means that 36 bibliographies and 32 journals were used for developing the reference model.

This review was the basis for identifying different variations of *VMI* and deducing a general version based on current literature.

To compare the variations of *VMI* mentioned in literature with the used variations in practice by companies, an empirical study was designed. Based on the identified *VMI* variations in scientific literature a questionaire was developed to compare these results with expert knowledge in practice. For this purpose half-standardized interviews with participants from companies operating in the sectors automotive industry (4), engineering (2), agriculture (1), cosmetics sector (1), food sector (1) or other (1) were conducted. The aim of this empirical study was to evaluate the

- relevance of *VMI* in practice,
- the practical suitability to meet business requirements and
- the existing variations of VMI in practice and theory.

Generally, this empirical study showed that the variations mentioned in literature are similar to the implemented variations of VMI in companies. Subsequently, the deduced *VMI* version from the literature study was extended and adapted based on the findings from the empirical study.

To show the effects of *VMI* on the business processes, a reference model with a high level of detail was required. Although the *SCOR* model is widely accepted and includes processes of the supply chain, the level of detail was not high enough to show the changes in the processes which are necessary in order to implement *VMI*.

The process reference model *LogWIN-P* includes processes in higher level of detail, so it is appropriate to show the influence of implementing *VMI* on the processes. So *LogWIN-P* was used as the basis to develop the *VMI* process reference model.

For developing this extended *VMI* model, a review of the existing model *LogWIN-P* was necessary. All levels of the model were checked and the potential *VMI* processes were marked, to pre-simplify the following modeling process.

Therefore the effort for modeling the *VMI* process based on the *LogWIN-P* model is very low and such models ensure that all important business areas are considered in the final reference model. Experiences of other firms and people are used for modeling the company's own processes, which helps to achieve a successful implementation of *VMI* (Becker and Delfmann, 2004, Schulte 2009, Hinkelmann 2008, Stary 2003).

This developed and extended model is called *LogWIN-P_VMI* and shows the ideal realization of *VMI* and helps to implement the necessary modifications.

The literature review and the findings of the empirical study were used to set up the *VMI* process.

LogWIN-P_VMI was developed based on the literature review and the empirical study. As *LogWIN-P* has a high level of detail, a top-down approach was chosen to set up all including processes.

Then the connections to the other existing processes of the reference model were evaluated and checked for accuracy. Following that, the modeled process was reviewed again and necessary adaptions were made.

4. IMPACTS OF VMI ON BUSINESS PROCESSES

The successful implementation of *Vendor Managed Inventory* requires a process redesign of existing business processes. For the redesign, knowledge about current processes and future *VMI*-processes is required (Arnold, Kuhn, and Furmans 2008, Alicke 2005). This implies that redundant processes are omitted and the responsibility for the execution of tasks can change sides, i.e. from the customer to the supplier or the other way round.

To implement this concept the use of a process-reference model can lead to essential benefits. It supports the reasonable and transparent visualization of processes, shows cut surfaces, simplifies the complex reality and serves as a common language between the supply chain partners (Alicke 2005).

4.1. The Process of Vendor Managed Inventory

The operative process of *Vendor Managed Inventory* (cf. Fig. 1) starts with the transfer of important information about current inventory and requirements (also including sales data, storage data, planned promotions and sales deals, future requirements, loss etc.) to the supplier. This data has to be transferred periodically (i.e. hourly, daily or weekly) and should be refreshed continuously to keep the information up to date, because production and transport cycles influence the inventory levels (1).

The received data gets checked by the supplier and a forecast for future requirements is created. Based on these forecasts the supplier schedules production, calculates necessary inventory levels and therefore confirms the order (2).

In the next step the supplier determines the net requirement of the customer and integrates it into the production planning process. The results of these three steps are the scheduled delivery dates and quantities. The supplier communicates these dates and quantities to the customer (3).

Subsequently the supplier delivers the goods to the customer. These deliveries have to fulfill the predefined conditions of the customer (i.e. minimal stock level). Together with the provided goods the delivery receipt is handed over to the customer (4), who checks the goods and the delivery receipt, confirms the delivery (5) and stores the goods. From this point on, the customer is the new owner of the goods (unless otherwise expressly agreed) (6).

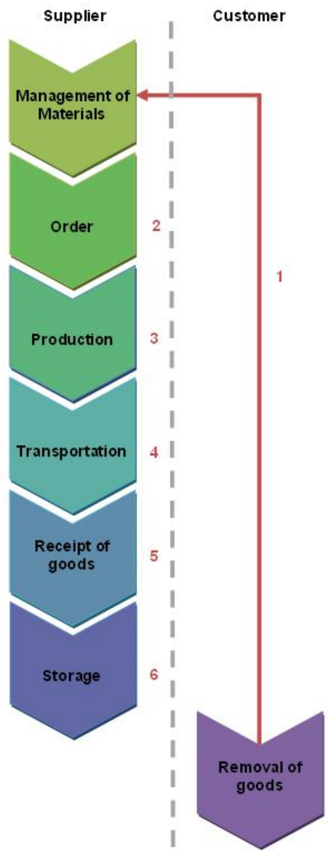

Figure 1: Process with *VMI*

Finally, the customer pays the invoice – mostly on a monthly basis as a collective invoice (Alicke 2005, Arnold, Kuhn, and Furmans 2008).

4.2. The traditional Process without VMI

As mentioned above, the process reference model *LogWIN-P* was used for developing the extended model with *VMI*. In *LogWIN-P* the traditional business processes are *Order Management*, *Planning*, *Procurement*, *Production of Goods and Services*, *Distribution* and *Research and Development* (Ortner, Rothböck, Stüger, Unterbrunner, and Wallner 2005).

In contrast to the in 4.1 described *VMI* process, in the traditional process (cf. Fig. 2), the customer creates the demand forecast and observes the inventory (1). Subsequently, the order size is defined and the ordering process is initiated (2). The supplier receives the order and processes it (3). Then the supplier delivers the ordered goods including the delivery note (4). The receipt of these goods is then confirmed and the payment is made by the customer, who takes over the ordered goods at this point (5) and stores them (6).

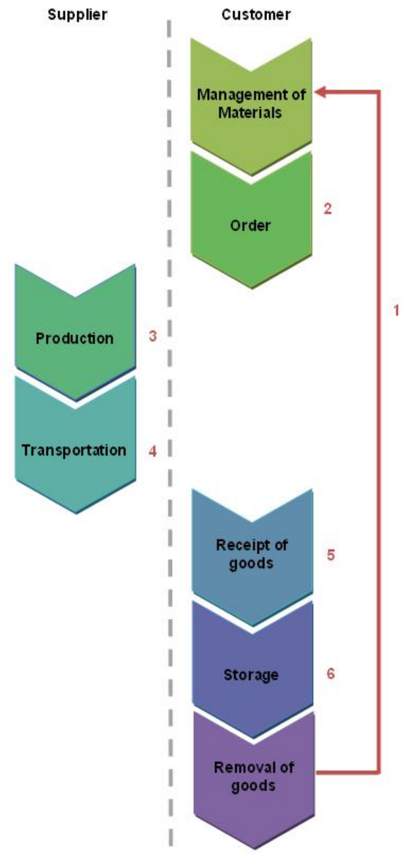

Figure 2: Traditional Process without *VMI*

As the description of these two procurement processes prove, the implementation of *VMI* affects the supplier as well as the customer. In the following sections these differences are therefore described separately for the supplier and the customer sides.

4.3. Affected Processes of the demand side

From the point of view of the customer mainly the procurement process is affected by *VMI*. As mentioned in chapter 3 Methodology this process information was generated from the literature review combined with an empirical study. To provide an overview, the traditional processes of *LogWIN-P* and the processes with *VMI* are shown in Figure 3 and Figure 4. The marked red processes point out the processes which are significantly, mainly or not affected by *VMI*.

The procurement process is separated into three main parts, which include detailed processes. These three parts are *procurement strategy*, *operative procurement* and *procurement infrastructure* (Ortner, Rothböck, Stüger, Unterbrunner, and Wallner 2005).

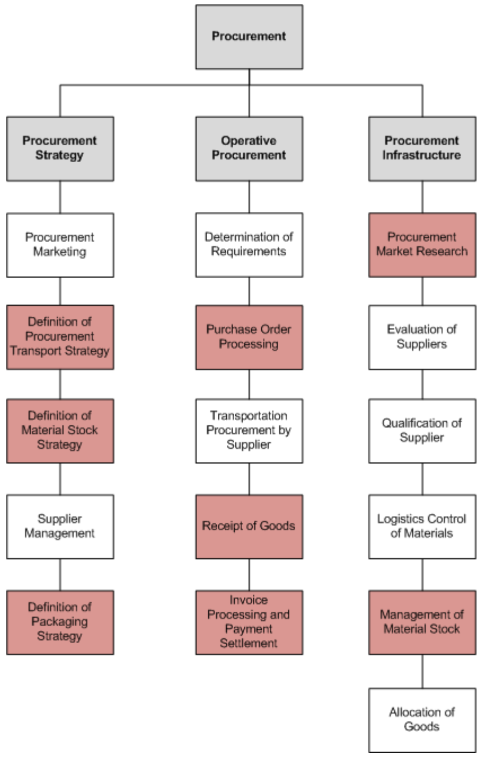

Figure 3: Traditional Procurement Process

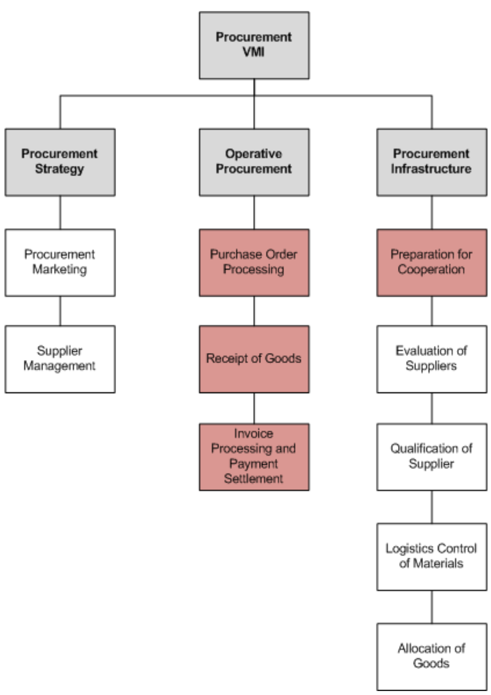

Figure 4: Procurement Process with *VMI*

The implementation of *VMI* can lead to the relocation of some processes to the supply chain partner (in this case to the supplier). In the following part the most essential modifications are explained in further detail.

4.3.1. Purchase Order Processing

The main steps of the *operative procurement process* are:

- ordering required goods by the customer,
- transporting these ordered goods by the supplier and
- receiving these goods at the customer's ramp.

The implementation of *VMI* implicates some changes in this process. Originally, the customer orders the products after checking the inventory levels as the supplier does not have access to the inventory and usage data of the customer. Then the supplier delivers the goods to the purchaser.

Within the *VMI*-process, the supplier receives inventory data and material requirements forecasts from the customer. This implies that inventory management is carried out by the supplier. Compared to the traditional process without *VMI*, the supplier retrieves the required data and sends an order acceptance notification via electronic data transmission to the customer. This order acceptance includes information about the scheduled delivery date and quantity (unless otherwise agreed).

After managing the inventory stock and completing the ordering process, the transport of ordered goods is arranged. The supplier is responsible for this activity – in contrast with to the traditional process.

The supplier can commission a third party provider (i.e. logistics service provider) to conduct this transport.

4.3.2. Receipt of goods

This process is part of the *operative procurement* and characterized by four main activities:

- receiving the ordered goods,
- inspecting the received wares,
- giving notice of goods receipt and
- storing them.

The process is initiated with the transportation of the ordered goods to the customer. There, these delivered goods are checked on the basis of a random sample or by in form of a complete examination and then the confirmation of receipt of goods is made. If the examination of goods is correct, the products are stored in the customer's warehouse. If the examination is not correct, a claim is made.

At this point, the goods are in the customer's warehouse and the customer becomes the owner (unless otherwise agreed). Subsequently, the invoice is generated and the payment is made. Furthermore, the supplier has to register the purchased goods in the inventory management system.

In the traditional process the received transport documents (dispatch note, transport notification) are compared with the order documents. This step is dropped in the *VMI* process, as the supplier organizes the whole replenishment process independently within contractually defined constraints.

4.3.3. Invoice Processing and Payment Settlement

The traditional payment process, which is also part of the *operative procurement*, starts with the change of ownership of goods after their delivery. Then the invoice is made and compared with the dispatch note or transport notification. If the invoice is correct, the payment is executed, if it is incomplete or incorrect a claim is initiated.

With *VMI*, the customer does not get the invoice directly with the supplied goods. In the majority of cases, the invoice is received and paid monthly. This collective invoice is compared with the dispatch notes and transport notifications of the whole accounting period. If the invoice is correct, the goods are paid. If the invoice is not correct or complete, the customer sends a complaint.

The major difference between the traditional and the *VMI* process lies in the delayed invoicing and payment.

4.3.4. Preparation for Cooperation

Preparation for Cooperation is a *procurement infrastructure process* which does not exist in the traditional *LogWIN-P* model, as implementing a logistical concept such as *VMI* requires an intensive preparation for this collaboration.

A properly functioning partnership is the basis for *VMI*. Initially, all activities and responsibilities have to be planned and coordinated. Afterwards, potential subcontractors have to be evaluated according to determined criteria (i.e. long term suppliers, certain appropriate products). Based on this evaluation qualified suppliers are contacted. If they agree to form a cooperation, common expectations and objectives have to be developed, discussed and defined in a cooperation agreement. This contract includes for example determined minimum/maximum inventory levels, transportation agreements or delivery times. Finally, the order processing according to *VMI* can proceed.

4.4. Affected processes of the supply side

From the supplier's point of view, it is the distribution process which is mainly affected by *VMI*. This process is separated into the three parts distribution strategy, operative distribution and distribution infrastructure. Figure 5 and Figure 6 provide an overview of the whole traditional process and the process with *VMI*.

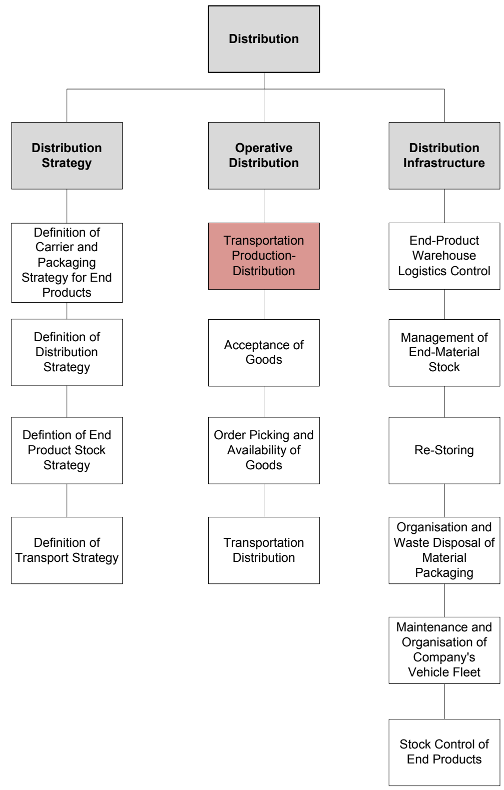

Figure 5: Traditional Distribution Process

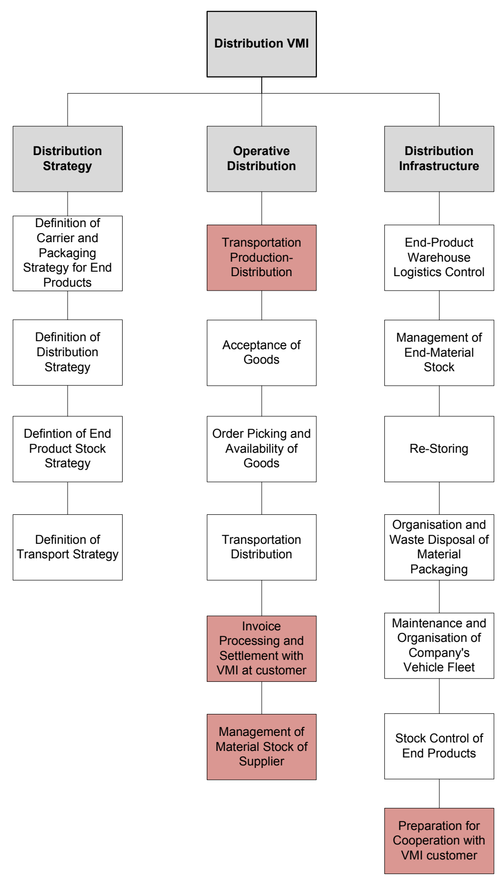

Figure 6: Distribution Process with *VMI*

The next section describes the main process modifications in the *LogWIN-P_VMI* model and the differences to the traditional process.

4.4.1. Transportation Distribution

The *transport distribution* is part of the *operative distribution* and is initiated by the customer removing goods from stock. This removal influences the inventory management of the supplier. If a certain pre-defined inventory level is reached, the supplier plans the replenishment of goods and transmits an order confirmation to the *VMI*-partner.

Subsequently, the transportation of goods is executed by the supplier, a logistics provider or the customer himself. Without *VMI*, the shipping documents are transferred directly to the customer and the delivery services are brought to account.

In comparison, the transportation according to *VMI* is done by the supplier or by a logistics provider, but not by the customer. The reason for this is that the point of transfer of ownership is relocated to the customer (the customer becomes the owner). The supplier is responsible for managing the customer's warehouse and consequently for the transport as well.

Furthermore, the process with *VMI* shows differences to the traditional process concerning payment of delivery.

After transportation, the shipping documents are handed over to the customer and the delivery is added to the collective invoice, which is usually sent to the client on a monthly basis.

4.4.2. Invoice Processing and Payment Settlement with customer

As mentioned in section 4.4.1 the process of generating the invoice and initiating the final payment according to *VMI* differs from the traditional process. This is a new core process, which does not exist in the traditional process reference model *LogWIN-P* and is part of the operative distribution.

In comparison to the traditional process, the payment is not made directly after delivering the goods, but is initiated periodically. The gathered dispatch notes of the specified accounting period are compared to the received invoice. If the charged goods and services are correct, the client pays the wares, if they are not correct the customer has to claim.

4.4.3. Management of Material stock of supplier

In the *LogWIN-P_VMI* model this process is now part of the *operative distribution*. In the traditional model, the inventory management is located in the procurement part. Within the framework of *VMI* this process has been outsourced to the supplier. As a consequence, the subcontractor takes over the responsibility of managing the inventory stock of the *VMI*-customer.

After removing goods from stock at the customer's warehouse and falling below the defined inventory level, the supplier receives a note of demand The *VMI*-supplier is able to retrieve the latest information (i.e. inventory or sales data or requirement forecasts) of the customer's *IT system* and checks the availability of goods in the supplier's warehouse.

If the required goods are available, the *VMI*-customer may receive information about delivery date and quantity and, additionally, the confirmation of order. If the goods are not available, the supplier informs the customer about the remaining quantity to be delivered and the delayed delivery date and additionally transfers the confirmation of this specified order. In the majority of cases, this occurs after unscheduled removal of goods.

4.4.4. Preparation for Cooperation with VMI-customer

As mentioned in section 4.3.4 *Preparation for Cooperation* (demand side) the preparation for implementing *VMI* is essential and therefore, the supply side of the *LogWIN-P_VMI* model was extended by this process as well. *Preparation for Cooperation* is part of the *distribution infrastructure*. If the implementation of VMI is initiated by the supplier, the planning and preparation takes place within the strategy development. However, in most cases, the client expresses the request for cooperation.

4.4.5. Summarized overview of the impact on the processes of LogWIN-P

After modeling the *VMI* process, the affected processes and modifications compared to the traditional process were shown. The following Table 1 and Table 2 provide an overview of all procurement and distribution processes of *LogWIN-P*. Based on the *LogWIN-P_VMI* model the tables are divided into the demand side and the supply side and show the *LogWIN-P* processes which are new or affected (significantly, partly or not affected) or sourced out to the partner.

Concerning the procurement process, a lot of processes are affected significantly or partly, and a lot of processes are outsourced and now part of the supplier's responsibility. Only the process *Preparation for Cooperation* is new in the *LogWIN-P_VMI* model.

Table 1: Impacts on Procurement Processes of *LogWIN-P* – demand side

			Affected			
	Procurement Process	New	Significantly	Partly	Not Affected	Outsourcing to partner
Demand Side	Procurement Marketing			x		
	Definition of Procurement Transport Strategy					x
	Definition of Material Stock Strategy					x
	Supplier Management			x		
	Definition of Packaging Strategie					x
	Determination of Requirements					x
	Purchase Order Processing		x			
	Transportation Procurement by Supplier					x
	Receipt of Goods		x			
	Invoice Processing and Payment Settlement		x			
	Procurement Market Research					x
	Evaluation of Suppliers			x		
	Qualification of Supplier				x	
	Logistics Control of Materials				x	
	Management of Material Stock					x
	Allocation of Goods			x		
	Preparation for Cooperation	x				

From the supplier's point of view most processes are new or not affected. Just one process is affected significantly, three are affected partly. Furthermore, no activity is outsourced to the partner of the supply chain (the customer).

Table 2: Impacts on Distribution Processes of *LogWIN-P* – supply side

			Affected		
	Distribution Processes	**New**	**Significantly**	**Partly**	**Not Affected**
Supply Side	Definition of Carrier and Packaging Strategy for End Products				x
	Definition of Distribution Strategy			x	
	Defintion of End Product Stock Strategy				x
	Definition of Transport Strategy				x
	Transportation Production-Distribution			x	
	Acceptance of Goods				x
	Order Picking and Availability of Goods			x	
	Transportation Distribution		x		
	End-Product Warehouse Logistics Control				x
	Management of End-Material Stock				x
	Re-Storing				x
	Organisation and Waste Disposal of Material Packaging				x
	Maintenance and Organisation of Company's Vehicle Fleet				x
	Stock Control of End Products				x
	Invoice Processing and Settlement with VMI at customer	x			
	Management of Material Stock of Supplier	x			
	Preparation for Cooperation with VMI customer	x			
	Processes from Partner				
	Definition of Procurement Transport Strategy	x			
	Definition of Material Stock Strategy	x			
	Distribution processes	x			
	Determination of Requirements	x			
	Transport Procurement by Supplier	x			
	Procurement Research	x			
	Management of Material Stock of Supplier	x			

The comparison of these two tables shows that some core processes of the customer and of the supplier are affected by *VMI* essentially or even partly. Another important outcome of this comparison is that a lot of activities of the customer were relocated to the area of responsibility of the supplier.

Therefore the supplier gains more flexibility concerning the planning and distribution process.

CONCLUSION

The implementation of *Vendor Managed Inventory* requires a modification of internal and supply chain processes. Primarily, the procurement and the distribution processes are affected by *VMI*. The customer outsources some activities to the VMI-supplier and the supplier is consequently more flexible in generating demand forecasts and planning production and distribution of goods.

The use of *LogWIN-P_VMI* can help both partners implement *VMI* and reduce the effort of adopting internal and supply chain processes.

For modeling this *LogWIN-P_VMI* model the *VMI*-process was designed based on a literature review and on an empirical study including information about the process-steps and the affected processes by *VMI*.

With this extended process reference model we think that companies, especially *SMEs*, get a support for modifying and adopting their business processes to *VMI*. It helps to estimate the impact of this supply chain concept on the internal and supply chain processes and supports the successful realization of *Vendor Managed Inventory*.

Based on these results we want to extend *LogWIN-P* by processes of other supply chain concepts such as *Just-in-time, Quick Response and Cross Docking*. This extended model will be an essential part of the research project *ILOG*, which investigates the implementation of supply chain concepts from the point of view of the three areas processes, information technology and logistics technology.

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