TEKNISK RAPPORT

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A Sawmills Potential Offering for Builders Merchants

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ABSTRACT

Vendor managed inventory (VMI) is a frequently used method for and a widely discussed partnering initiatives for improving supply chain efficiency. VMI as a program has increased in popularity, especially in the grocery industry, where the supplier, reseller or distributor makes the main inventory replenishment decision for the consuming organization.

The objective of implementing VMI programs is to decrease costs for inventory control and management, and create transparency; possibility to collaborative planning and replenishment and efficient consumer response.

The theoretical framework presents the basics of VMI, what the effects are and what prerequisites for such a program demands. The theoretical framework is used for the model of analysis when analyzing the possibility to implement VMI from a sawmill perspective to one of their customer segments; builders merchants.

This is a case study performed at a small and medium sized sawmill. The purpose of this study was to investigate the possibilities of theoretically implement VMI since the Swedish wood supply chain is in a need for new business models and services since the value refinement is too low.

The current system for inventory management and replenishment is summarized and compared to a theoretical construction with VMI. The analysis shows total settlement days could increase with 50%. This has a positive effect on the net cash flow and the inventory turnover per year could almost double. Further does the relationship between Case Company and Builders merchant fulfill the requirements for implementing a VMI program, but there is reason to be aware of the potential pitfalls.

SAMMANFATTNING

Leverantörsstyrda lager, Vendor managed inventory (VMI), används frekvent och är en av de mest diskuterade partnermodellerna för att utveckla effektiviteteten inom logistik. VMI program har ökat i popularitet, speciellt inom dagligvaruhandeln och betyder att leverantören, återförsäljaren eller distributören beslutar om lagerpåfyllnad för den konsumerande organisationen.

Målsättningen med att införa VMI är att minska kostnader för lagerstyrning och kontroll och genom att skapa transparens ge möjlighet till gemensam planering, påfyllnad och effektivt mäta kundens behov.

Den teoretiska referensramen innehåller grunder inom VMI, effekterna av densamme och vilka krav ställs på ett sådant införande. Den teoretiska referensramen används för analysmodellen för att utreda om det är möjligt att införa VMI hos sågverkens kunder; byggvaruhandeln.

En fallstudie har gjorts på ett små- och medelstort sågverk. Syftet med studien är att utreda möjligheterna att implementera VMI på ett sågverk. Bakgrunden är att den globala konkurrensen och råmaterialtillgången och prisökningen för att skogsnäringen måste arbete med att utveckla nya produkter, tjänster och affärer för att behålla export och sysselsättning. Den stora tekniska och affärsmässiga utmaningen ligger i att genom innovationer och nya affärsmodeller ta till vara alla delar av skogsråvaran för att möta det största hotet: den låga förädlingsgraden.

Nuvarande lagersystem och påfyllnad är jämfört med ett teoretiskt utformat system. Analysen visar att antalet dagar för bundet kapital minskar med 50 %. Detta har givetvis en positiv effekt på kassaflödet och lageromsättningen kan nästan dubbleras. Relationen mellan sågverket och byggvaruhuset uppfyller kraven för införande av VMI. Men det finns anledning att vara försiktig då det finns fallgropar med sådana program.

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INTRODUCTION

Background

The Swedish sawmill industry is between a rock and a hard place (Nord, 2005) and the small and medium sized (SME) sawmills are even worse. The national market has been low in historical perspective but the Swedish market has been even building less than comparative Nordic countries. Followed by a global recession and revolution in the some of the countries in Northern Africa combined with a strong national currency has put additional pressure on the mature sawmilling industry. Large scale sawmills has put even more pressure on the SME sawmills forcing them to prioritize niche markets and cash flow over profit. If the SME sawmills are to survive and even prosper they need fundamentally rethink the way they are doing business and delivering customer value.

In addition the global recession based on the bank crisis in North America and euro crisis has decreased the consumption in the traditional markets for export such as UK, USA and North Africa. During the crisis the national currency (SEK) has gained on euro giving the actors in Sweden a disadvantage to other producing countries. In order to survive the crisis there has been a focus on cash-flow which leads to negative net income.

One way to increase the margins is to add more value to the timber based products. This demands development of new products and services, in interaction with the customer and to understand the customer's customer needs. Possible solutions are to integrate with the reseller through services such as Vendor Managed inventory (VMI). VMI is program that gained attention during the latter part of 1980's when it started to be used in large scale and has expanded since to several industries (Niranjan, 2012).

The builder's merchants do, as sawmills tie capital, in inventories. At the same time most of the builder's merchants cannot give forecasts to the sawmills other than on a yearly basis, since each department store is a legal entity and accumulated demand data is rarely collected centrally and cannot be therefore distributed.

Purpose

The purpose of this report is to explore VMI, what effects VMI have and gain an understanding of the program and the effects and prerequisites. The purpose is also to investigate how WMI could be adopted to sawmill and builder's merchant's Supply chain relation.

The questions asked during this period of time are:

1. What is VMI?
2. What are the prerequisites and are they fulfilled in the timber value flow between sawmills and builders' merchants?
3. How would the supply chain design be with VMI?

Delimitations

The study focuses on one relationship between one builder's merchant and one sawmill. There are also other customer segments for the sawmilling industry, but these are not considered in this report.

METHOD

Research Strategy

VMI is a well-known method in several fields, however with limited focus on VMI in Swedish the timber value chain. The research strategy is to use the case study approach, thus it's explorative to validate theory through empirical research i.e. a deductive approach. According to Yin (2002), a case study approach is a suitable strategy for explorative questions. The case study approach is thus a suitable research strategy for the research in this report, since the objective is to develop an understanding of the concept of VMI and its application in the timber value flow and its context.

Single-case study approach and design

The case company, sawmill, has been financing the researcher. Therefore it was contacted for a single-case study. The case company was selected based on their explicit statement of willingness to develop their services. The idea was to elaborate on new services that can be found in literature and test the ideas with the case company.

The rationale for a single case study is to validate a well formulated theory (Yin 2002). The theory for VMI is tested within the case which makes the single case study an appropriate selection. Single-case studies have often been criticized for the difficulty to draw generalizations. Because VMI studies have been conducted before, the reliability increases as beginner's previous mistakes in method are considered.

Research Process

Yin (2002) advocates that it is important to describe the research process both for judging the quality and keeping the study flexible without changing purpose or the objectives. The research process began with literature studies. Yin (2002) advocates that theory should guide the case study design. The initial theoretical framework was used as a starting point to get an accurate picture of the theory before designing the VMI solution and testing it in workshops. Thereafter there was planning of the company visits including the workshops that were to be carried out. Then the three workshops were conducted with the case company. Finally there was analysis of the workshops based on the theoretical framework and the writing of this report.

Data Collection Methods

Literature study

The theoretical frame of reference is mostly concentrated on VMI. Moreover, in order to get a broader picture of alternative methods related to order and inventory management, other methods within Supply chain management (SCM) were studied as well. These related theories and methods were: Collaborative planning and continuous replenishment (CPFR) and efficient consumer response (ECR).

Archival data and documentation

The archival data and documents studied in the case study involved inventory records, order records and balance sheet documents and the company website.

Workshops, interviews and participant observations

VMI, as method, was discussed during two workshops. The workshops were carried out at the case company's production site (See ***Table 1***)

Table 1 Summary of workshops at the case company

Data collection	Date	Purpose	Participants	Notes
Workshop 1	2012-02-29	Broad discussion of VMI	Production Manager, Sales Manager, Maintenance Manager, Managing director	
Workshop 3	2012-05-23	VMI as a service	Production Manager, Sales Manager, Maintenance Manager, Managing director	
Workshop 2	2012-09-19	General discussion about Sawmill basic conditions	Students from Logistics course, Managing director	The student report has been used for secondary data

Between the workshops, interviews were conducted. All interviews were unstructured interviews, where the respondents afterward had the opportunity to verify a summary made by the interviewer. Participant observations were made at the work-shops. The observations contribute to the researcher's general knowledge and understanding of the case (Miles and Huberman, 1984).

Validity and Reliability

According to Yin (2002) logical tests can be used to verify the quality of research: Construct validity is reached by using multiple sources of information to triangulate the results of the study and creating a chain of evidence. Internal validity targets the data analysis phase and concerns the researcher bias. External validity reflects the possibility to make generalizations of the findings from the case studies but where there is a difference between analytical and statistical generalization. Reliability targets to reduce errors and biases in a study.

In order to strengthen the validity of the case study in this report a priority has been to give the respondents opportunity to verify the correctness of the interviews and workshops. In addition interviews were triangulated with archival documents and home pages. Participant observations have given the researchers a possibility to compare interviews with documents and action in the workshop.

VENDOR MANAGED INVENTORY – AN OVERVIEW

The basis of VMI is that the supplier, reseller or distributor, assumes the responsibility for the consuming company inbound inventory management. It means that the supplier has control of its customer's inventory levels, items and makes the decision when to replenish. It's a necessity to share demand forecasts between the customer and the supplier, which makes it possible for the supplier to plan its processes (Gronalt, 2008).

The process of ordering inbound material is the supplier responsibility, which instead of having a delivery reliability objective towards the customer, has a service level responsibility to the customers customer or a machine group at the customer (Waller, 1999).

This means that the planning, transaction and the physical supply process differ according to the traditional process (***Figure 1***). The customer gives input about demand instead of purchase orders, the supplier creates replenishment order from their planning system based on actual inventory levels and the safety stock can be moved partly or totally to the consuming process.

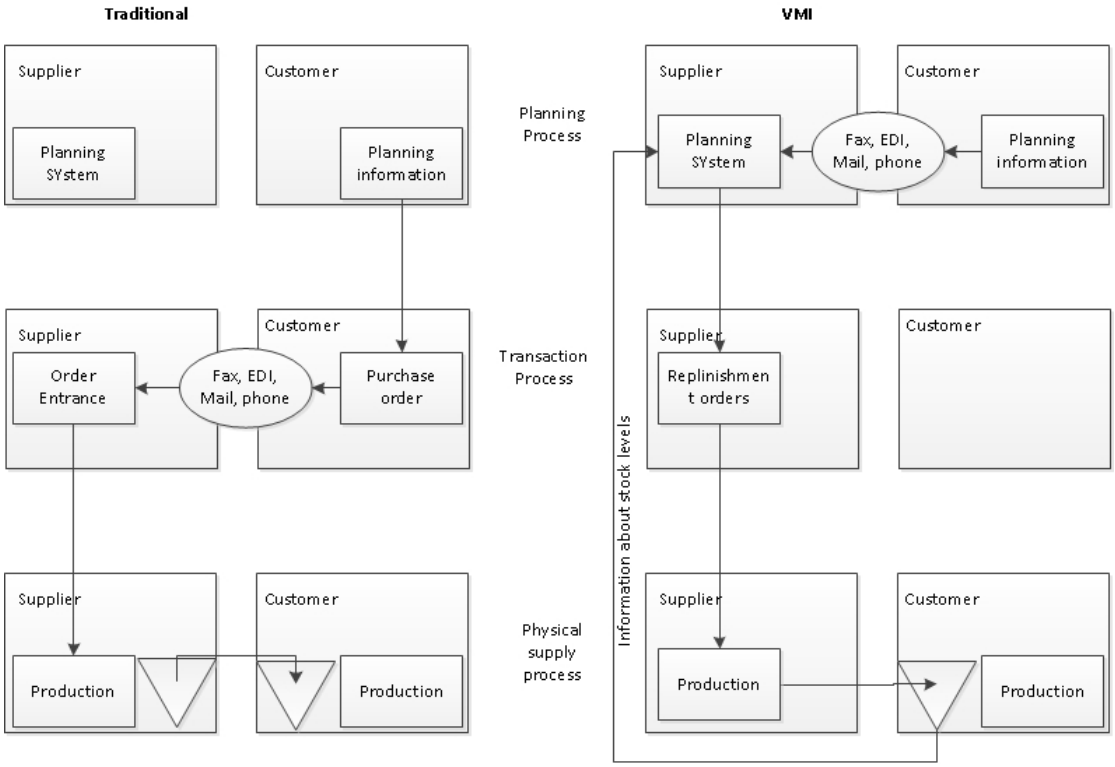

Figure 1Traditional Planning, Transaction and physical supply process compared to VMI (Claassen & Weele, 2005)**.**

Prerequisites for VMI

The basis for VMI is a close cooperation between the supplier and the customer and that necessary information is shared between the parties (Claassen & Weele, 2005). Lack of trust form any of the parties will lead to reluctance to share information, which will decrease the likelihood of a successful VMI cooperation (Niranjan, 2012).

The objective from both parties must be a win-win, the trust is not necessary just because from information sharing but also since the customer loses control of the daily replenishment decisions and the call-off process. The supplier must have the same competence as the customer. This does not however imply that the customer should be passive and let the supplier have all the problems. Customer commitment is as important for the likelihood of implementing VMI (Disney, 2003)

The product characteristics are also a central issue for a successful VMI. The products that are appropriate for VMI should be selected carefully. According to Nirnjan, Wagner & Ngyuen, (2012) high volume are most beneficial. VMI collaboration is also simplified if the numbers of items are not too large (ibid)

It is also important to understand that bargaining power in the form of share size means that a relatively large customer versus supplier or the opposite makes the likelihood of success less (Henningsson & Lindén, 2005).

VMI implementation

There are factors that can hinder an effective implementation of VMI collaboration; openness, common objectives, information sharing, maturity and the relationships between parties (Claassen & Weele, 2005). These factors need to be improved during the implementation and governance of the VMI program.

The focus has to be a strong relationship, the structure of the collaboration (relationship, item assortment) and maturity (Process, ICT, organization, culture) according to Claassen, (2005).

VMI Technology

The parties involved in VMI do usually already have order, inventory and sales processing systems which need to be integrated in order to be able to share information. The vital information is customer demand and inventory level, replacement date and delivery advice (Waller 1999).

Even though it is not necessary to use EDI in a successful VMI implementation (Waller 1999), real-time-information for both the supplier and the customer is beneficial.

VMI Benefits and drawbacks

The benefits from mutual understanding of each other's processes lead to a stronger relationships and a possibility to collaborative development (Disney, 2003) and together the supply chain can gain a competitive advantage compared to other chains. Another benefit is information transparency, giving better information for decision making and minimizing the risk of sub optimizing the inventories (Claassen & Weele, 2005). The total cost should be lower.

The VMI information transparency makes it often possible to reduce the demand plan time horizon giving a much more flexible supply chain with smaller inventories, more efficient transport and increase of service levels (Waller, 1999). The project cost has also often a short payback period of few months.

From the supplier perspective the benefits are faster and more reliable information (Claassen & Weele, 2005), the Bullwhip effect is reduced and inventories can be

reduces (Yao, 2008), the supplier can better plan the production process by reducing batches and finished goods inventory (Yao 2008, 361), Reduction of transportation costs (1998), increased understanding and overview of the market leading to better forecasts (Claassen & Weele, 2005), and increased capital turnover (Reitner et al., 2012).

For the customer the benefits are Reduction of costs by outsourcing the material planning process (Claassen & Weele, 2005), Shorter lead-time giving reduction of inventory costs (Yao, 2007), and costs of planning, order processing is also reduced (Claassen & Weele, 2005).

Challenges for a VMI implementation are mutual understanding and design of processes, Integration of ICT and other information sharing processes can take time, short term incentives before long term gains (Disney, 2003), and the supplier has to take risks and costs what the system (Corsten & Kumar, 2005).

THE CASE

The case sawmill, founded in 1944, which made a strategic decision in 2010 to increase the production of value added components. Until then sawn timber has been the major source of revenue. The objective is to offer components, products and services to the market by the end of 2013 and for these products to be major sources of (***Figure 2***):

- Planed and sawn components
- Processed timber components including precut, drilled and milled to fit their customers' building systems
- Industrial surface treatment of timber components with pre-fabricated base and finish painting
- Wall and floor elements in timber for individual family houses and multi-storey houses
- Trusses
- Sawn timber roof sheet with pre-fabricated painting and sarking felt

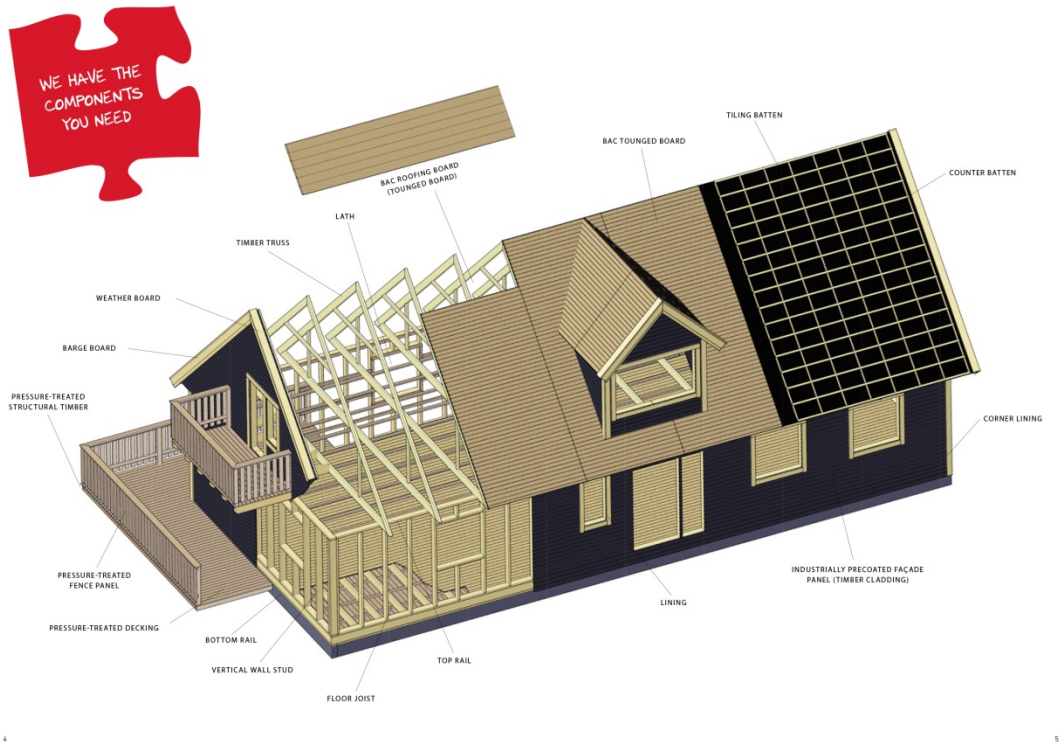

Figure 2 Case study offering wood based components

The timber component supplier has developed relationships with three builders' merchants over a long period of time.

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1963 acquisition of a regional building products reseller, which was the first of two builder's merchants, was the starting point forward integration. By owning the sales channel the company was not so dependent on the export markets. The reseller would be a part of the Woody builder's merchant chain during 2008. The reseller became a builder's merchant and DYI retailer and opened another store 2006 with the same

concept of 400 000 products needed for new and repair building products. The retailer consolidation was met by joining the Interpares purchase organization and Woody building products chain. The retailer business was sold 2010 to the Danish Bygma group.

The Owners and board of directors has made a strategic decision to forward integrate through product development and development of services connected to these products (sequence deliveries, traceability, packaging and distribution, Vendor managed inventories, etc.). This is the strategy to level the demand due to cyclical variation in export markets. The owner expressed the cyclical variations:

"…in the sawmill industry seven bad years are normally followed by one good year"

The sawmill industry has over capacity and consist of large corporations (SCA, Södra, etc.) and many SME sawmills. Most of the sawmills have a divergent product structure which leads to a rather complex product structure due to the number of stock keeping units (Wetterblad et al., 2012).

The general production strategy is MTS, with some MTO. There is a large seasonal variation in both raw material supply and customer demand. It's easier to access and transport timber during winter since they can utilize winter roads. Customer demand is high during the summer months. Which means that there is a need for inventory building during six months and often explains why the dominate production design is push and batch-oriented.

Builder's merchants are divided between professional sales (BM) and consumers (DIY). There has been an establishment of large department stores. This market is also affected by seasonal variation. Most of the resellers have a large number of stock keeping units (SKU: s) from different suppliers, even when it comes to timber based products. The department stores act a separates legal entities and often with low competence within logistics according to the CEO (Wetterblad et al.; 2012).

The decision are made on past experience and gut feeling rather than calculated service degrees and safety stock which should imply that the inventories generally are too high in order to not have back-orders (Wetterblad et al., 2012)

The normal procedure is that the builder's merchants decide on the delivery terms and inventory control. Short lead-times are expected, normally three days after purchasing order. The builder's merchant's main issue is to have high safety stock levels in order to have a good service level and reduce lost sales. The same is with sawmills versus builders merchants. This means that excessive safety stock exists at both physical locations (Wetterblad et al., 2012).

Information exchanged is very low. Sawmills makes their own forecasts based on previous year sales and really no information exchange except for order, order confirmation and invoice is done (Wetterblad et al., 2012).

Delivers are often done by third party distributors, such as Schenker and DHL, with short lead times which give opportunity to transport planning very little (Wetterblad et al., 2012).

VMI IN TIMBER VALUE FLOW

The VMI as a concept is tested theoretically on the supply chain; the current structure for one builder merchant's chain is described, a future model is elaborated.

Current supply chain

The current supply chain consist of sawmill and ten department stores all over Sweden with 153 SKU's. No aggregated forecast, except for one annual during the negotiation of terms. Each department store has their separate inventory policy. Lead-time for production one item is five (5) days, where one day is actual machine processing time. The average finished goods inventory is 8 weeks, where about two weeks is safety stock. The transportation to the department store is 2 days and one days is for goods receiving (Wetterblad et al., 2012)

At the department store average inventory is 4 weeks, where about two weeks is safety stock. The normal credit days are 30 up to 90 days after invoicing. Total time from production start until payment is received is between 99 and 159 days (Figure 3).

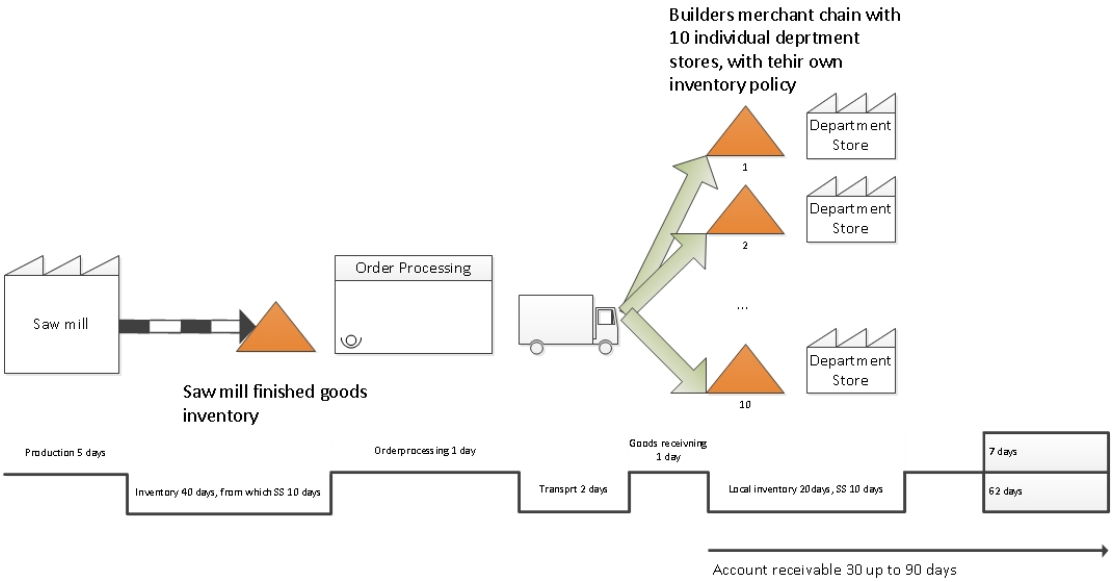

Figure 3 Current supply chain design adopted from (Wetterblad et al., 2012)

The issues the sawmill is facing in order to have an efficient production, without having too large safety stock is due to several factors (Wetterblad et al., 2012):

- Insufficient forecasts
- No coordination with campaigns
- The customer is a "black hole"
- Making priorities
- Short lead time
- No service levels has been established
- Customers are not used to back-orders
- Safety stock

Insufficient forecasts means that the sawmill does not get any forecasts from the central purchasing order except for an annual forecast, and since there is no collection of orders or demand to a central organization the sawmill would have to contact each

department store for forecasts. This is not done today. According to the sales manager:

"*Might be difficult to get the department store managers to give forecast since this is not often done on a SKU level and they handle so many SKU's so they wouldn't have the time to give us the figures*"

The saw mill does not receive either any information about a specific campaign so they do not have the possibility to stock up before a possible sales campaign. Campaigns cause also fluctuations in the sales forecast.

Often the customer is a black hole, and sometimes there is a feeling that some department store have excess material and some are running out, but because there is no possibility to see inventory levels it is impossible to make distribution between department stores but also very hard to prioritize between department stores. According to the production manager the lead-time of three days makes it hard to make good production plans, and especially during the summer period when there are a lot of stock-outs the production cycle becomes ineffective and "we would like to be able to run larger batches".

Another difficult aspect is that "service levels objectives" have not been established in the contract. This means that the department stores can expect a delivery at any order size whenever as long as it is within three (3) days. Even though this seems naïve the explanation from the sales manager is that "*the industry is not accustomed to use service level as a key performance indicator and any sawmill that says that they don't have 100 % service level will not issue a contract with any builders merchants*". Every party is aware of the fact that some lost sales or back orders will exist, but they are not measured.

The department stores are not used to back-orders, either they get a complementary product (often higher quality) at the same price or they will call another sawmill. Often the builders merchants have 2-4 sawmills that can supply them with items so it will not be a problem. However this means that the transportation will not be effective.

The safety stocks are not calculated but based on previous expertise. Actually since service level has not been established it is impossible to calculate adequate safety stock. An observation is that during the 18 months of visiting only one "out-of-stock" delivery where mentioned and seemed to be a big issue. Therefore the conclusion is that it seldom happens, which probably means too large safety stocks.

VMI supply chain design

By constructing a design for the saw mill and builders merchant example using the theoretical framework it could be the following (Figure 4). The saw mill takes the full responsibility of the timber assortment at the builder's merchant department stores. This means that the saw mill is responsible for the replenishment orders and the physical distribution of items to the builder's merchant's department stores. The saw mill does in fact own the SKU's until they have been sold by the department store, even though they are physically stored at location. Invoicing is made automatically when the builder's merchant has sold the goods to their customers.

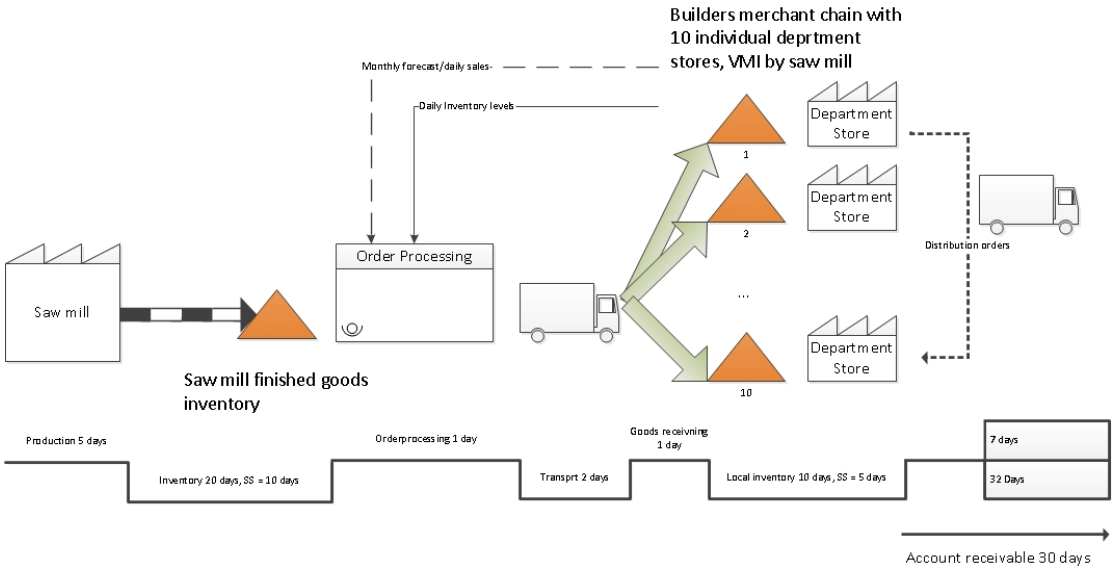

Figure 4 VMI supply Chain Design Adopted from (Wetterblad et al., 2012)

The sawmill will have the responsibility of the builders merchants other purchase orders, as well their replenishment orders, but continuously receiving information about inventory level, demand forecast and sales. In order to enable this information exchange EDI could be used that is already implemented (Wetterblad et al., 2012).

The inventory levels and safety stock would be mathematically calculated from the customer demand. This could mean that the saw mill could optimize its production cycles. This gives an opportunity to organize around a pull system between the saw mill and the department stores.

The safety stock could probably be reduced and stored at the saw mill, since it is statistically easier to forecast on the total rather than on the individual department store. By using pull system and continuous replacement the safety stock can be minimized at the department store. In this case only 5 days at each department store, compared to two weeks before. The finished goods inventory can be replaced with a 2 week stock (totally 4 weeks). Service level is set to 90%.

The Sawmill will aggregate the sales and forecast figures from each of the department store, which does not exist today. This can be used to utilize the production by merging orders to production orders, which reduces exchange of dies.

The sawmill coordinates the transportation to the different department stores, giving an opportunity for route planning and even distribution between the department stores depending on the actual sales. This means that the total demand can be leveled towards the sawmill production and reduction of the bullwhip effect, this gives also an opportunity to efficiently fill up the trucks.

This means that the saw mill should set up the individual department store inventory policy and handle logistics for all stores instead of letting that be handled by a part time function at each department store. This way competence in logistics can be centralized and hopefully depended. The forecast will get better and safety stocks can

probably be reduced at the individual department store without jeopardizing out-of-stock situation. By this, together with assortment control, the improvement work could be optimization of the inventory levels.

The department stores will reduce its capital since the saw mill will own the goods until point of sales. Therefore the credit time should not exceed 30 days. With the new structure the total time 32 days instead of 62 days not looking at the cash flow, which is almost 51 %.

Inventory turnover (times/year) = number production days per year / throughput time days)

Current supply chain 230 / 62 = 3.7 times VMI supply chain design 230/32 = 7.2 times

With the reduction of inventory and focusing on continuous replacement the inventory turnover, and thereby capital turnover, is almost doubled. But in order to be able to proceed with this the saw mill needs sales and inventory data continuously.

Even if the safety stock is as large on the whole it will be less than if you would have the same safety stock on each department store, statistically. Each department store has a safety stock based on 'gut feeling' which means that they can be reduced. By this the service level for the whole system is going to be equal compared to today's situation.

VMI – Implementation

There are several pitfalls to be taken count with such a program:

- Neither the sawmill or the builders merchant has experience from such use of logistics programs, since they don't even today calculate the safety stocks
- At least the sawmill would have to recruit someone with such competence
- The builders merchant must share information about the customer behavior, seasonal variation and campaigns and other sales knowledge which means that there has to be mutual trust
- The role of the local purchaser at each department would have changed positions where it's more of coordinator and information transfer, which might lead to resistance both at the saw mill but also at the builders merchant.
- Standard operations for warehousing and inventory management at each department store where they are used to local policies
- The builders merchant might exaggerate the forecast in order to secure service levels

For builder's merchants that are a part of a voluntary chain in order to gain economies of scale in marketing and procurement (Fransson & Rehme, 2005) it might become more difficult since the element of voluntarily participation makes it more difficult to have a common strategy. This might also make it possible for the small saw mill to have an offering that increases delivery reliability, high collaboration and less hassle with handling orders, since the saw mill is actually handling the orders which are valued by the builders merchants (Fransson & Rehme, 2005).

DISCUSSION AND CONCLUSIONS

Summarizing the questions for this study (p.4);

- What is VMI?

VMI is an, increasingly popular, inventory management program based on that the supplier takes responsibility for replacement at the customer site.

- What are the prerequisites and are they fulfilled in the timber value flow between sawmills and builders merchants

The prerequisite are fulfilled or can be fulfilled in the timber value flow. However the fact that the saw mill and the builders merchant are not used to discuss in terms of service level might increase false expectations. This could be handled by following up current service level and have that as the initial value, which then could be increased.

The demand has a seasonal variation, but is otherwise relatively settled. The production flow is continuous in order to meet the customer demand and all the SKU are sold in large volumes which implies that VMI could be work in this environment.

The transportation logistics is handled through trailers with frequent delivers which also is prerequisite for VMI. Many of the benefits (leveled production, increased information, reduced inventory level) that are general for VMI could also be applied in this contextual setting. This means there is a potential benefit to start such a program.

Many of the saw mill and the builder's merchants in Sweden have low margins and net income which implies that the primary focus should be cost reduction as the potential driver for implementing a VMI program.

- How would the supply chain design be with VMI?

The saw mill would take more responsibility, compared to the situation ´today where the saw mill is merely and order receiver and supplier. The safety stock at the department stores could be reduced and the capital turnover in the total system could be increased. This gives an opportunity for the saw mill to add value to their offering and offer additional services to the builder's merchants.

The conclusions are based on a theoretical assumption. Real figures with actual data would be needed to clarify the situation and verify if it is possibly to implement VMI and the total cost and a cost and benefit analysis. This could be made through simulation. Validation of data should be viewed carefully since that might be exaggerated, from the saw mill, in order to prove the concept.

The study would benefit from studying a large number of suppliers and builders merchants, since the data is from a single case study.

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