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INTEGRATION OF SUPPLY CHAIN EXECUTION IN B2B-MARKETPLACES – EXPERIENCES FOR NETWORKS OF SMALL AND MEDIUM SIZED ENTERPRISES

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ABSTRACT

Though B2B-marketplaces are still in the early phase of their existing, they had been subject of various adjustments. We can even identify several evolution steps in their development during the past few years. One of the most important developments is the integration of logistic services and the focus on the achievement of new business value through combined strategies involving e-business and Supply Chain Management (SCM). In particular for small and medium sized enterprises (SME) linking forces using B2B-marketplaces with supply chain optimization functionalities opens new horizons to improve inter-organizational processes. In this paper we outline the relationship between B2B-marketplaces and SCM and we argue that both concepts converge within modern models of B2B exchanges. A case study undertaken at a vertical marketplace in the furniture industry illustrates the results achieved through the integration of SCM functionalities with this marketplace.

Keywords: e-marketplaces, SCM, SME, B2B, Transportation, Inventory.

1. INTRODUCTION

While the early B2B internet platforms served as e-procurement tools supporting mainly short term relationships and aiming to reduce the transaction costs in the procurement of non-production items, the new wave of marketplaces acquire their economic value through a widened scope of services and the support of collaboration and synchronization between organizations.

The SCM concept also has been subject to evolution since its beginning. Though the estimation, it is not clear what exactly SCM is [Kotzab/Schnedlitz 1999], we can state that the focus of this concept goes more and more beyond the optimization of the processes within the boundaries of a single company towards a holistic view of the supply chain. Modern models and standards for SCM are dedicated to consider whole value chains and many-to-many relationships. Thus, the supply chain is no more seen as a sequential concatenation of suppliers and customers but as an entity itself.

In the last years, the relationship between both concepts has been subject to constant changes. From the stage of marketplaces serving logistic services and claiming to support supply chain optimization, and SCM-systems supporting the settlement of on-line trading, we currently find out a convergence of both concepts especially through new business models integrating them in private or consortia based e-marketplaces. While these combined strategies were a privilege for large-scale businesses in private exchanges, meanwhile there are efforts to transfer them also to SME.

In this paper we describe the evolution of both concepts: B2B-marketplaces and SCM as well as the opportunities for SME by building internet-based collaboration networks. Chapter 2 deals with the evolution of both concepts. It points out on the basis of current trends within consortia backed marketplaces and also at the example of the proposals to enhance the CPFR processes, that B2B exchanges and SCM are converging. This development can be considered as an opportunity for SME networks to realize supply chain efficiency using internet-based marketplaces. Chapter 3 describes a case study at a vertical marketplace which participants are typical mid-companies. Moreover, it illustrates the efficiencies reached when integrating SCM functionalities in B2B exchanges. Chapter 4 closes the paper with some concluding remarks.

2. CONVERGENCE OF B2B-MARKETPLACES AND SUPPLY CHAIN MANAGEMENT STRATEGIES

The e-marketplaces concept is often described on the basis of the phase model of coordination [Schmid 1993]. This model identifies three phases: Information, Agreement and Settlement. After-Sales services are often considered as a fourth step [Linck 1998]. The mission of e-marketplaces is considered thereby in the support of these phases. Their role can be identified in three major aspects [Backos 1998]: matching buyers and suppliers, facilitating transactions and maintaining institutional infrastructure. B2B exchanges emerged from this background as the type of e-marketplaces supporting the coordination between businesses.

The SCM concept grew from another background, namely logistics. The Global Supply Chain Forum defines SCM as follows: “Supply chain management deals with the management of materials, information and financial flows in a network consisting of suppliers, manufacturers, distributors and customers. The coordination and integration of these flows across companies are critical in effective supply chain management” [Kotzab/Schnedlitz 1999]. Therefore, SCM includes the systematical coordination of inter-organizational relationships involving carrier and warehouse keeper [Mertens 1998] and manages three complementary areas: the information, the material and the financial flows [Klaus 2000].

Both concepts represent modern strategies for the coordination and collaboration between companies. We outline the past steps of the evolution processes they had been undergoing and discuss the relationship between them.

2.1. EVOLUTION OF B2B-MARKETPLACES

The first step in the evolution of B2B exchanges can be lead back to the creation of internet-based shops and the related marketing activities of a single company. But in consideration of the gathering of products offerings of different suppliers as indispensable functionality in markets, B2B-marketplaces emerged first with the procurement exchanges, which brought together sellers and buyers of certain goods or services. At this stage, B2B-marketplaces concentrated mainly on demand aggregation and were used as procurement tools for a type of goods whose specification is considered as simple, such as Maintenance, Repair and Operation (MRO) products and indirect production materials. This type of goods has a small strategic importance and its relative transaction costs are very high especially in large companies due to the administrative overhead. The goal of e-marketplaces in this first phase and also the main argument to invest in their building was the reduction of both transaction costs and time. The marketplace operators intended to make profit from charging transaction fees and were therefore reliant on achieving a critical scale. Besides the skepticism on the supplier-side because of pricing pressure and on the buyer-side because of additional fees to third-party, the logistic issues were often neglected and caused difficulties that absorbed the promised lowering in the transaction costs. These

facts lead to adaptations of existing business models and also the emergence of new types of e-marketplaces. The following phase was therefore characterized by the enhancement of existing exchanges through additional services. E-marketplace operators hoped in this way to create a true value-added for their customers (marketplace participants) and to reach the aspired scale. Other B2B-marketplaces followed a different strategy. These were industry consortia backed and realized their value proposition through the support of collaboration in the supply chain. Currently, B2B trading platforms are much more than order and auction systems [Schneider/Schnetkamp 2000]. They can support whole trading networks from the planning of raw materials up to the selling to the final customer, supporting new structures and relationships in the supply chain. Thus, the value proposition of B2B-marketplaces is moving away from price minimization towards cost optimization through improved efficiencies and tightened coordination between buyers and suppliers. The future of exchanges is predicted in deeper support of supply chain towards collaborative design and building of Value Trusted Networks [Raisch 2001]. Another future development is seen in the so-called exchange-to-exchange integration (E2E): the integration of different marketplaces. Modern standards such as UDDI (Universal Description, Discovery and Integration) and current efforts confirm this trend.

At the present time we distinguish mainly three types of B2B-marketplaces [Starr et al. 2001]:

1. Private Exchanges : This type of e-marketplaces enables a company with dominant position in the supply chain to strengthen the collaboration and synchronization with its trading partners. The most known examples among private exchanges would be eHub from Cisco or Valuechain.dell.com from Dell. Through the existing information about the connected partners, it is much easier to build business intelligence. Of Particular importance is the ability to get an early warning if a member has production problems and to react in sufficient time on this exception. The private exchanges can be subdivided into E-Procurement and E-Sales platforms.
2. Consortia-based e-marketplaces or vertical marketplaces: These exchanges link the members of an industry consortium with their trading and logistics partners and cover therefore more levels of the supply chain as the private exchanges. They can be driven through the consortium or a third party operator. The latter variant is particularly relevant for SME.
3. Independent e-marketplaces : In this case an independent operator enables buyers and sellers to link their activities using his platform. These marketplaces can concentrate on special types of goods or services, e.g. fulfillment, or offer a broad mixture of products and goods (horizontal marketplaces).

2.2. THE EVOLUTION OF SCM

Although the SCM concept has grown up from the background of logistics, there are main differences between both fields. While logistics concentrates on the processes within a single business and deals traditionally with the functions of transport, trans-shipment and warehouse management, the focus of SCM consists in the coordination of inter-organizational processes and assumes a holistic, integrated view of the supply chain.

The beginning of SCM can be marked through initiatives such as Efficient Customer Response (ECR), Just in Time (JiT) and Vendor Managed Inventory (VMI) supporting mainly 1:1 relationships of trading partners. At the same time, several organizations and committees established various standards for the modeling of supply chains and the collaboration between suppliers and their customers, which also often assumed 1:1 relationships and considered the supply chain as a concatenation of such relationships. One example of these standardization efforts is the Supply Chain Operation Reference Model from the Supply Chain Council [SCOR 1998]. During the following time, SCM systems were coming more and more closer to their original aim of a global view and optimization of companies networks. Their functionality is no more part of Enterprise Resource Planning (ERP) systems, but

rather implemented in separate packages offered from leading software vendors. Consolidation processes and the need to strengthen cooperation in order to become more competitive are reinforcing this trend. As the competition is shifting from individual companies to entire supply chains, SCM systems have to afford the necessary configuration, planning and execution tools to analyse and optimize the supply chain as an entity itself.

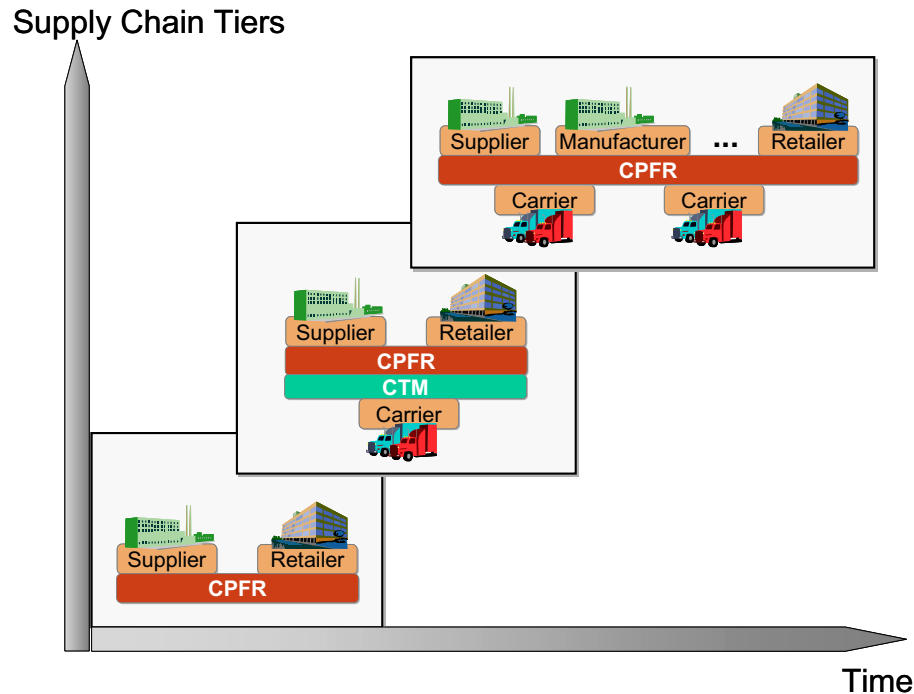


Figure 1 The evolution of CPFR

The evolution of SCM can be illustrated at the example of the CPFR concept. The Voluntary Inter-industry Commerce Standard (VICS) published in June 1998 a standard for Collaborative Planning, Forecasting and Replenishment (CPFR), which is meanwhile a well-established model. It consists of a nine-step process that helps in automation and improvement of sales forecasting and replenishment between two partners. VICS extended this concept later by giving the carriers the ability to build business plans with key customers to reach a better service of the delivery requirements. This extension is defined in the Collaborative Transportation Management (CTM) initiative. CPFR is currently being adjusted to embrace so-called 3-tier and n-tier models, i. e. not only 1:1 or 1:many collaboration but also multi-level relationships along the supply chain. The CPFR committee has also extended its research into e-marketplaces and came to the conclusion that they can contribute to and even play an important role in an efficient realization of the CPFR concept, from the original version up to the n-tier variant. The areas of contribution, as well as the complexity of the tasks are widely variable. They may range from data collection and exchange of inventory information up to the management of supply chains via B2B-marketplaces [CPFR 2001]. Depending on the implementation degree, the business relationships of the connected companies are likely to improve to a great extent.

2.3. RELATIONSHIP BETWEEN B2B EXCHANGES AND SCM

Currently, three fields can be identified in the context of the relationship between B2B-marketplaces and SCM:

1. First SCM involves the coordination of online and traditional delivery channels. The settlement phase of each transaction on e-marketplaces, whether it concerns the own platform or third party exchanges, includes logistic processes which must be taken in consideration when planning demand and supply in a given network.
2. On the other hand, e-marketplaces can be used as supplement to the efforts to get rid of inefficiencies in the supply chain. Thus, B2B exchanges for logistic services promise support for SCM efforts. For example the auction based exchanges for transportation services aim to improve the utilization of transport capacities.
3. The modern types of B2B marketplaces are covering both trading processes as well as the underlying logistic services. They represent therefore a new dimension in the relationship between B2B exchanges and SCM. Integrated strategies enable the marketplace operators to reach two important goals. First to be in control of the complicated logistic issues in e-commerce because of the ascended number of deliveries, shorter delivery times and higher quality of service expected from the customers. And second to offer benefit for the participants through improving their collaboration and eliminating inefficiencies in their supply chains.

The shift in the mission of e-marketplaces away from spot transactions towards long-term relationships and the efforts to achieve a true win-win situation let SCM and B2B exchanges intersect. In consideration of the fact that SCM aims for a global optimum in the supply chain and that it requires therefore at least a virtual centralization [Christopher 1998], we come to the conclusion that B2B exchanges, which are central systems, can build the basis for SCM. Moreover they allow solving two of the major problems faced by SCM systems: discontinuities in the information flow and the lack of trust among the different partners [Knolmayer et al. 1999]. All the data needed for the supply chain optimization can be shared on the marketplace system which takes the role of an integration backbone. The neutrality of the operator of the B2B-marketplace could also promote the creation of trust [Schoop/List 2001].

	Independent Exchanges	Industry Consortia	Private Exchanges
Supply Chain Planning			
Supply Network Planning	[-] [-]	[+] [-]	[+] [-]
Production Planning & Detailed Scheduling	[-] [-]	[-] [-]	[-] [-]
Demand Planning	[-] [-]	[+] [-]	[+] [+]
Transportation Planning	[-] [-]	[+] [-]	[+] [+]
Available-to-Promise	[-] [+]	[+] [+]	[+] [+]
Supply Chain Execution			
Controlling	[-] [-]	[+] [-]	[+] [+]
Order Processing	[-] [+]	[+] [-]	[+] [+]
Transportation Execution	[-] [+]	[+] [-]	[+] [-]
Warehouse Mgt.	[-] [-]	[+] [-]	[+] [-]
Support Tasks			
Data Management	[-] [+]	[+] [-]	[+] [+]
Communication	[-] [+]	[+] [+]	[+] [+]

Figure 2 E-marketplaces support for SCM functionality

The three described types of B2B-marketplaces offer different advantages for the participating companies and can support specific SCM functionalities in different ways and at different degrees. These are illustrated in Figure 2. We indicate in this figure two levels in the functionality included in SCM systems [Gehr et al. 1998]: the planning and the execution levels. Support tasks perform the underlying information and communication services.

Horizontal or independent e-marketplaces support the SCM functionalities only in a limited way because of the nature of transactions on these exchanges which are of short term, and also because of the lack of standards and the high product diversity. At a glance, the private exchange is the most useful type for introducing the supply chain optimization between member companies. But in many cases this type of marketplaces connects only direct suppliers and customers to a large partner. In this respect industry consortia backed market-places represent a big potential in the implementation of SCM. They can support a multi-tier integration of connected partners since companies of the whole value chain of a specific industry could be linked to the e-marketplace.

2.4. INTEGRATED STRATEGIES FOR SME

Like in large companies, e-marketplaces were used by SME in a first step to improve their marketing activities and promote the acquisition of new customers. Some of them had to follow the requirements of larger customers and therefore to get involved in their exchanges. Thus the role of SME within e-marketplaces has often been restricted to figure as participant at horizontal marketplaces in order to realize cost savings through power-buying opportunities or to get an additional sales channel, or to be linked to private exchanges of larger partners. Another chance for SME in the context of virtual marketplaces is seen in their linking as logistic service providers [Reichling 2001].

On the SCM side, SME have simultaneously accumulated needs for the use of systems optimizing their value chains. They often do not have the necessary resources to evaluate an efficient supply chain system. Because of the license fees and due to the high implementation costs, SCM systems have had limited success among this type of enterprises. The concerns about long introduction time as well as the lack of qualified staff inhibit the implementation of such expensive systems in SME. Consequently, SCM systems for SME and especially for SME networks have to satisfy mainly three conditions: the implementation and service costs have to be appropriate for businesses with limited IT resources, the usability of the system must be as simple as possible in respect to the human resource factor and the systems have to be customized to the special needs of SME that can do without sophisticated planning systems. Moreover, customization is typically a cost intensive process that could cause the ruin of small businesses. The integration of new partners should be simple to preserve the flexibility of SME networks.

According to this, the key focus when searching appropriate solutions for SME are the lowering of the necessary costs and the elaboration of industry oriented and flexibly expandable software architectures. Several approaches are being elaborated and tested on this field. One possible solution consists in the enhancement of existing ERP packages for SME to support SCM functionality, following the example of vendors of standardized systems. But the SCM tools in ERP systems for SME are often restricted to the implementation of XML interfaces or EDI conversion tools. Another approach is Application Service Providing (ASP) where user of software packages pay a subscription fee. But this model is afflicted with two main difficulties: First the lack of integration and information sharing even when ASPs offer more than one system. Second the lack of customization. A further worth mentioning solution is based on the componentware (CW) concept [Friedrich 2000]. The basic idea of CW is to reuse existing code and the packaging of individual functions in software components. These are intended to contribute to flexible extensible, individual systems, at low costs.

B2B exchanges open new possibilities as well to involve mid-companies in supply chains of larger partners, or to optimize networks of SME. E-commerce technologies and central systems with web

access afford the possibility to overcome the barriers of cost and complexity and let the SCM focus be extended to the browsers of medium enterprises. Considering the scenario of a SME network, the industry consortia model of B2B marketplaces seems to constitute a real chance for collaborating mid-companies to take full advantage from the innovative perceptions in the SCM area. All conditions mentioned above can be met through the characteristics of these marketplaces: cost-effectiveness, customization, usability and flexibility.

3. CASE STUDY: ELECTRONIC MARKETPLACE IN THE FURNITURE INDUSTRY

3.1. GOALS

The example of a vertical B2B-marketplace in the furniture industry illustrates how small and medium sized businesses can rid supply chain inefficiencies through supply chain enabled exchanges. The surveyed marketplace is developed and operated by the ecenta AG (Nuremberg, Germany), an IT provider on the field of vertical marketplaces.

Furniture.ecenta.com was launched in January 2001. It provides an integrated software platform that connects multinational companies (Suppliers, Manufacturers, Intermediaries, Wholesalers and logistic services providers) in ways going beyond the buying and selling of goods and focusing on order processing, the integration of fulfillment processes and the improvement of the inter-organizational workflows between participant companies along a supply chain. The marketplace members are typical SME.

The basic functionality of the marketplace supports the procurement and sales processes offering a set of tools that aimed at the beginning to enable wholesalers, intermediaries and manufacturers to coordinate their corresponding trading processes. Later carriers were integrated and then suppliers of production materials. The basic functionality of the marketplace includes catalog systems for customer specific articles, based on the CSA-PRICAT standard [Butterwegge 2001], procurement tools including product configuration, and a workflow engine that coordinates the inter-organizational flows of information and generates alerts by exceptions. The marketplace offers also clients management services and a role based web interface for each partner.

The goals of the cooperation between ecenta and the Bavarian Information Systems Research Network (FORWIN) were to study the possibilities of the integration of logistic services within e-marketplaces, to enhance the e-marketplace for furniture through such services and also to promote the SCM integration efforts. Because of the nature of the member companies, the supply chain execution aspect had priority. In the following, we outline the integration of two functionalities at the marketplace: the transportation scheduling and optimization, and the raw material procurement.

3.2. INTEGRATION OF TRANSPORTATION SERVICES

The transport is often referred to as the forgotten link in the supply chain. Though the impacts of e-commerce on transportation are widely identified, few solutions have been developed to deal with the challenges imposed through fragmented deliveries, the accrument of new delivery regions and the higher quality of service claimed by customers. A supplementary concern in this context is that the IT infrastructure of Less than Truck Load (LTL) logistic provider is often insufficient. On the other hand, we notice that transportation represents the greatest single cost category in logistics and therefore the most important place to make cost savings. In the case of the cooperation network linked at furniture.ecenta.com, the transportation costs represent about 30% of the total costs. The retailers and

intermediaries complain about big delays in the deliveries, the carriers on their part about the poor utilization of their fleet.

The integration of transportation scheduling and optimization at the marketplace aimed to better coordination between the manufacturing and delivery processes, to bundle the transport needs in order to reach a better utilisation of the used fleet and to higher the quality of service. The integration approach that we developed targeted also to optimize the delivery routes in order to achieve cost reduction and to improve the customer satisfaction.

To reach these goals, a transportation server was conceived and installed at the marketplace system. This has to integrate the settlement processes and to realize a link to logistics providers, i. e. to provide them with the IT functionalities they need. It has also the task of scheduling the transport orders, bundling them to delivery plans and optimizing the routes by implementing algorithms for the so-called Vehicle Routing Problem (VRP) [Laporte et al. 2000]. The implemented methods were based on adjustments in known algorithms, namely the saving-algorithm.

The data flow in the transportation server is illustrated in figure 3. It is integrated within the marketplace via XML data exchange and generates delivery proposals which have to be checked from the carriers controller. After they are confirmed, the marketplace system generates the delivery plans which can be downloaded from the manufacturers and intermediaries.

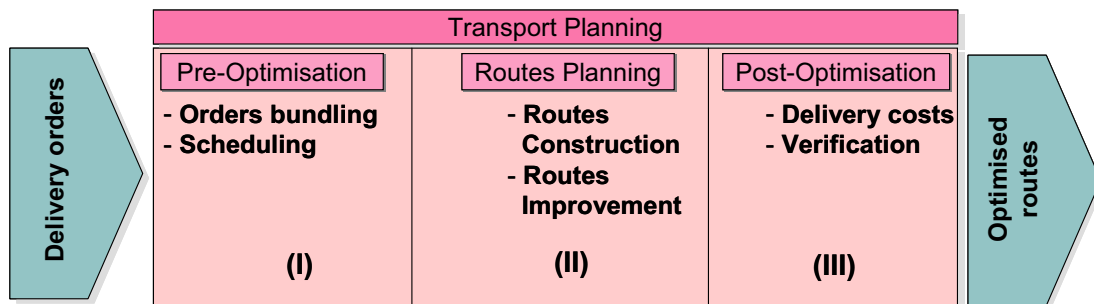


Figure 3 Transportation Server

The introduction of the transportation server led to big efficiencies in the surveyed collaboration network. The comparison of the average transportation costs before and after this implementation revealed a lowering of about 10%. Moreover the utilisation of the truck fleet could be improved by 36% and the number of the delivery trips could be halved.

It seems very important for all sides, including the marketplace operator, that the realized component allowed the achievement of a new business value rather than shifting value from one participant to another. It also achieved efficiencies that wouldn't be possible without the marketplace and its holistic view of the collaboration processes: the used pricing model is independent from the utilisation of trucks and also from the number of trucks used, so the wholesaler would be indifferent versus such an optimization effort, the lack of transparency and infrastructure retarded as well the logistic service provider to realize it.

3.3. RAW MATERIAL PROCUREMENT AND INVENTORY MANAGEMENT

Inventory often represents a dilemma in the supply chain. Shortages and excesses in inventory can generally be traced back to the lack of clarity of inventory data, the lack of integration with transport management and the insufficient consideration of delivery deadlines. The consequences are insufficient supply, inadequate response to short term changes and late recognition of exceptions. In the surveyed network in the furniture industry, the lack of raw materials on stock for a given order let the production time jump from several days to several weeks.

The challenge and at the same time the opportunity for the marketplace system is to add value by offering accurate inventory information, coordinating the material flows and integrating procurement and production processes in the supply chain over all partners. In this way the exchange can achieve the required inventory visibility and afford that information replaces inventory.

In our example, the manufacturers share a warehouse for a part of the raw materials. The management of all the activities related to the procurement of these materials should be coordinated on the marketplace system. In consequence another tier of the supply chain, the raw material suppliers, has to get connected to the system.

Figure 4 illustrates the steps of the procurement process of raw materials. This is based on the Manufacturing Resource Planning (MRP I) concept and is integrated with the inventory management.

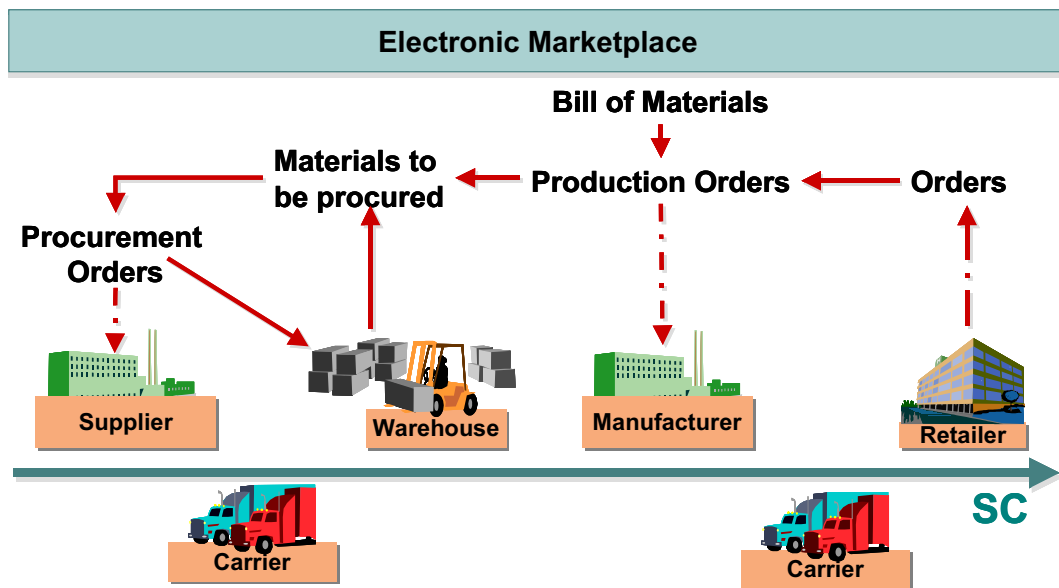


Figure 4 Information Flow in the Raw Material Procurement

For each sales order the system creates a production order and at the same time derives the material need from a bill of materials linked to the marketplace. This bill of materials leans on the same data model for customer specified products used for the final products. The defined articles in this model are the basis for both procurement and inventory. After the production orders are created, the inventory in stock is assigned to them according to their priority. For materials that do not exist in stock, the procurement engine generates a procurement proposal. This proposal is checked through a controller from the logistics service provider who has appropriate access to the system and who can adjust the quantity and select the supplier of the materials. After its confirmation, the proposal is converted to a valid procurement order. The functionality of goods receipt is integrated as well. The warehouse keeper can confirm the receipt of the ordered materials which will be added to the stock and in a first time locked for the corresponding production orders. After they are assigned to these orders the eventual overflow is accounted in stock.

An important efficiency of the procurement module is the enhancement of the order tracking functionality by the consideration of procurement and inventory information. Each order on the sale side can be matched to its corresponding production order which itself identifies a raw material procurement order. The integration of this component in the marketplace system allows the monitoring of each order and its related materials. It realizes also an additional value-added through the bundling of production materials needs which is translated into cost savings. Another efficiency is the possibility of the integration with the transport management, combining the transportation needs of both final goods and raw materials.

4. CONCLUSION AND NEXT STEPS

Through the enhancement of B2B exchanges with logistic functionalities and through the linking of more tiers in the supply chain, companies can reach supply chain synchronization. The system illustrated in this paper concentrated on the integration of supply chain execution tools. This has to be viewed in the context of the surveyed marketplace, which is focussed on optimizing existing processes and responding to the requirement of a specific network. Though the strategic level of optimization is not considered, B2B exchanges could, in other scenarios, be interesting for brokering such functionalities.

Further steps in the development of the presented modules are currently planned. Until now, the implemented transport server allows only the collaboration with contract carriers. A further step would be its integration with transport marketplaces and the study of integrating web services. On the other hand, the raw material procurement component will be expanded through collaborative forecasting functionality, which should improve the availability of raw materials and shorten the order delivery time.

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