Management and Production Engineering Review
Volume 9 • Number 2 • June 2018 • pp. 13–19
DOI: 10.24425/119521

APPLICATION OF VALUE STREAM MANAGEMENT TO ENHANCE PRODUCT AND INFORMATION FLOWS IN SUPPLY CHAIN NETWORKS – BASED ON THE EXAMPLE OF WEB-BASED AUTOMOTIVE RETAIL BUSINESS

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Received: 1 February 2017
Accepted: 8 May 2018

Abstract
Due to globalized business operations, companies in different economic sectors are part of complex supply chain networks. Their value-added processes comprise product and information flows, e.g. with a focus on manufacturing, service or trade. Until the final product is delivered to the end customer, it needs to pass many different processes in cooperating organizations. As a result, there a lot of business-to-business (B2B) interactions with cross-enterprise transactions, often including cross-border communications and sometimes even cross-industry trades with technological and often cultural implications. Especially the interfaces of supply chain networks are prone to inefficiencies, misunderstandings and delays due to a lack of standardized B2B transactions, which leads to waste in form of rework, errors and mistakes. In addition, new customers are hard to find for the manufacturing or trading company, since potential customers are so far limited to a regional network. The advantages of extending the customer base still need to be explored by many organizations. This paper discusses the opportunities by streamlining the communication along supply chain networks in a general fashion and then describes the application in a B2B automotive retail business. A concept of a web-based trading platform, which provides a seamless service for all steps of a convenient and efficient used vehicle remarketing business, is developed. It includes all phases, like offering and price finding in a comprehensive online platform, which also covers further activities, such as logistic services, financial transactions, and a mandatory feedback loop.
The suggested B2B vehicle-trading platform enables a quick turnover of each transaction, which is analyzed and optimized based on the application of cross-enterprise Value Stream Management.

Keywords
business process engineering, business-to-business, communication, operational excellence, supply chain management, supply chain networks, trading platform, value stream management.

Introduction

In today's globalized business world almost all companies operate in supply chain networks. Only a minority of companies sell their products and services directly to end customers. Most companies trade their products with other enterprises, which include them as work-in-progress in more complex modules or merchandises, thus increasing their value. Any business-to-business (B2B) interaction with a commercial partner is subject to cross-enterprise transactions, often including cross-border commu-

nications and sometimes even cross-industry trades with technological and often cultural implications. The communication interfaces to the international business partners include significant potential for misunderstanding and error, which create waste, inefficiencies and delays along the value stream. In addition, the number of potential customers is usually limited to the operating business partners, which are often based on a regionally limited network. The advantages of a broader range of commercial contacts still need to be explored in a globalizing world. Every B2B transaction is tailored specially to the two partners and thus subject to communication errors and mistakes.

Root cause is the non-optimized flow of information in B2B interactions. There is a lack of structured communication flows, because each interaction has new characteristics, concerning data content or format, logistic requirements and means of payment.

The purpose of this paper is to address the difficulties of product and information flows in cross-company B2B supply chain networks and to develop an innovative solution based on a trading platform. The current and future state of the supply chain are then assessed by means of cross-enterprise Value Stream Management.

Thus, the paper is structured as follows: After this short introduction, the state of the art in the field of supply chain networks and Value Stream Management is presented. To cope with the identified challenges, the methodological aspects of the innovative platform solution are then described in the three subsequent sections. In this context, the need for fact-based, data-driven, inter-company communication is explained to enable a common technical understanding between the business partners. Furthermore, the advantages of standardizing cross-company processes in supply chain networks similar to standardizing internal corporate processes are elaborated as well as advantages and challenges related to an automated exchange of product data. In addition, the practical feasibility of the theoretical approach is demonstrated in a use case from an automotive B2B retail business. The penultimate section deals with the process analysis and optimization by means of Value Stream Management, followed by a concluding summary of the major findings and results.

Literature review/state of the art

In the scientific literature, there are multiple approaches available in terms of supply chain networks. For a conceptual clarification, the differences between the terms "value chain" and "supply chain" are explained by [1]. In an exploratory case study, the combined view of value chain and supply chain leads to the definition of "value chain architecture". In [2], challenges of supply chain network optimization models with regard to four categories of modeling and organizational principles are discussed. On the way towards a better synchronization of supply chain organizations, [3] presents a comparison of approaches for supply chain network design. Agility in value chains, flexibility and change management are analyzed for different industrial sectors [4]. The current state of B2B connectivity, challenges of non-standardized communication flows and advantages of communication standards like EDI and XML can be found in [5].

The tool Value Stream Management (VSM) that originates from Lean Manufacturing, comprises the analysis, design and planning of value streams based on identified improvement potentials [6, 7]. In fact, multiple VSM approaches for the capturing, assessment and continuous improvement of product and data flows in supply chain networks are available, but there is a lack of a holistic and standardized method to achieve harmonized process and communication flows beyond corporate borders. Thus, these issues are addressed and opportunities for streamlining data in complex supply chain networks are shown in the following sections of this paper.

Data-driven communication

Any communication flow may be subject to error or misunderstanding. This is already true inside an organization, with known colleagues and established business partners. However, in the case of long lasting contacts, common terms and clear definitions were established in the past.

Along the supply chain network, the exchange between experts is based on common knowledge, facts and terms, which are tailored for the transaction at hand. But even with experienced professionals, the exchange of information must be fault-tolerant to avoid misinterpretation. Any dichotomy must be excluded.

When it comes to data exchange along the supply chain network, these data require interpretation by an experienced expert to transform the data into meaningful technical information. While communicating ambiguous product features or urgent project changes, the seamless communication along the value chain is restricted by different corporate data structures. Due to time pressure often quick communication channels, like verbal messages (e.g. phone calls)

are used, which may be interpreted differently by sender and recipient. Even written communication based on e-mails or fax is not perfectly linked to the IT structures of both companies and consequently leads to inefficiencies and waste. Often Excel sheets, hand drawn sketches or blurred pictures are used to cascade parameters, which are critical for the price or lead time of the product or service. This communication "in a rush" creates misunderstanding or misinterpretation of the data and is frequently root cause for waste by correction.

A common procedure of knowledge representation along the supply chain network is mandatory.

Common data structures are required. The data structures include product information, like CAD data, commercial information, such as costs and timing, and, depending on the kind of business, may even extend to the seamless exchange of manufacturing information, like MES data. These common data structures can be accomplished either by a common database, standardized data interfaces or suited data translators (cf. Fig. 1).

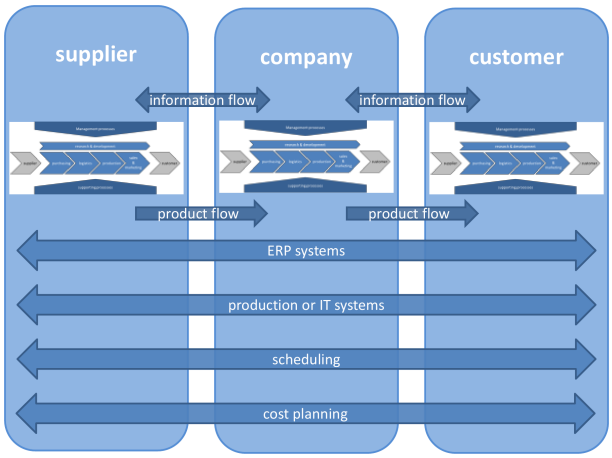

Fig. 1. Interfaces in supply chain networks [8].

Standardizing the communication flows

The path of communication inside an enterprise is commonized based on the corporate requirements and the specific business process. However, along the supply chain network, the structure of communication flow, e.g. concerning means of data exchange, data format and data content, often changes. The cross-company communication of technical data is specific for each product, every process step and all business sectors. When cooperating in B2B networks, the data interfaces are specific for each partner, and require a new, detailed definition. They have to comply with the procedures of both partners. At the same time, the interfaces need to remain flexible enough for being adjusted to the next customer, requiring minimal effort. This adjustment to the different IT systems of the business partners may even occur automatically. It requires common working procedures of the partners and defined data structures, which allow access to each corporate IT system of both companies. Today, the communication channels are tailored for each business. The process of intercompany business is non-standardized, usually defined by the larger or more powerful partner. Every transaction is subject of individual adjustment, thus each operation is different.

Therefore, the B2B communication must be based on standardized procedures.

A reproducible exchange of meaningful information based on reliable and speedy communication paths enables a quick turnover and timely completion of each transaction. The comprehensive exchange of clear and concise information based on a mutually agreed upon process flow leads to convenient and profitable business along the supply chain.

Expanding the customer base

The customer base in supply chain networks is usually limited. Going beyond the established commercial partners may offer the opportunity to acquire additional clients. Likewise, intermediate vendors or distributors can be eliminated, which increases the profit margin of each transaction. Worldwide offering may attract additional customers, who are potentially willing to pay a higher price for the product or service than the limited, established local network.

Pioneered in the 1980s by Walmart and Proctor & Gamble, vendor managed inventory (VMI) is today well established in B2B trade of manufacturing industry. All automotive corporations use global supply chain portals like "GM Supply Power" [9], "VW GroupSupply" [10] or "SupplyOn" [11], which were introduced by the Tier 1 suppliers Bosch, Schaeffler and ZF. However, these portals only cover the specific requirements of large OEMs. They still need separate handling of related services like transportation or payment.

The data exchange is usually tailored to the specific B2B transaction and the traded product. There are application specific electronic data interchange (EDI) formats defined, like OFTP2 [12] in automotive industry or Fortras [13] for logistic services.

Common EDI accelerates the B2B exchange of data and avoids human errors when transferring da-

ta between business partners. Through eliminating any human interaction, the data are free of misinterpretation enabling a common understanding of the information. The instantaneous and reliable access to the unambiguous product description by all business partners along the supply chain accelerates the business transaction and eliminates any waste. Manual order confirmation or data re-typing is not required any more.

An efficient use of EDI in automotive retail business is currently not established. Even though vehicle evaluation systems (e.g. CARFAX) are available, there is no recognized standard for common car check systems.

Automotive retail business platforms, like eBay Motors or auctions like BCA (British Car Auction) or Manheim [14], only cover some aspects of the commercial transaction. They do not include required activities like assessment of the car, transportation, and payment services. These essential actions are performed separately in every vehicle retail transaction.

Use case in automotive B2B supply chain

In this chapter, we describe the application of an integrated vehicle-trading platform, which will innovate automotive B2B supply chains. The platform has been developed by the industrial partner based on the theoretical findings of this work. The selected case study is part of a research approach with methodological aspects from Action Research and Design Science [15, 16], where the researchers are continuously in contact with industry to validate the developed approaches.

The used car retail business is highlighted with yellow arrows in Fig. 2.

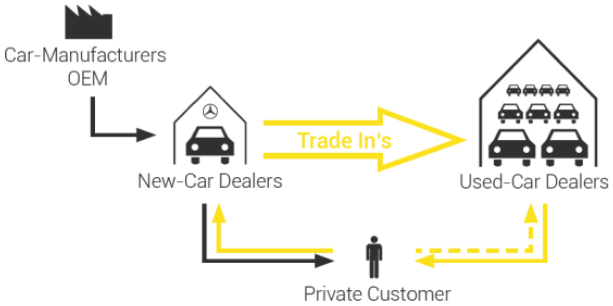

Fig. 2. Product flow in automotive retail business.

Today, the quality of the description of the product "used-car" depends on the experience, care and accuracy of the seller and is often hard to understand, sometimes even confusing or not completely correct (cf. Fig. 3).

Fig. 3. Product descriptions are subject to misinterpretation.

To evaluate used vehicles in a common way, a Graphic User Interface (GUI) is proposed, which guides the seller step-by-step through the evaluation process, covering all important features, which are relevant for the price finding of the car.

New car dealers, fleet and leasing companies as well as used vehicle dealers follow the standardized process of documenting the conditions of the used vehicle with the help of Cartron©, which is based on the GUI described above. Eventually, the product is documented in a graphical, unambiguous representation with all features, which are critical for the price finding process, like equipment level, defects or kilometer reading.

Replacing the established phone calls, newspaper advertisement and individual mailings by modern, web-based communication will streamline automotive B2B retail business (cf. Fig. 4).

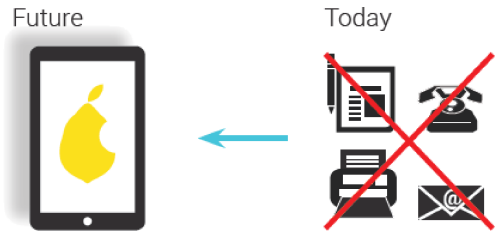

Fig. 4. Means of communication in automotive retail business, in future and today.

After importing the description of the used car into the database of the online trading platform, this information will be immediately available to dealers around the globe. The information is provided in a format, which covers all critical aspects for the potential buyer to provide a meaningful offer. Depending on their market needs or purchasing requirements, interested retailers can store preselected queries enabling them to bid for the product. The offering on a global platform enlarges the number of interested dealers, which will lead to a higher demand and thus price for the seller. It also excludes, or at least reduces cascading sales of the same car to multiple downstream dealers, which usually divides

the profit margin to multiple dealers. This shortcut in terms of trade streamlines the supply chain and eliminates trade levels, as indicated in Fig. 5.

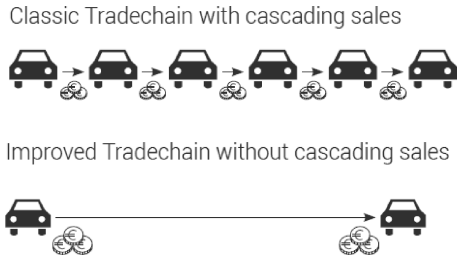

Fig. 5. Short-cut of the automotive trading chain.

As car-remarketing includes shipment, the trading platform has an integrated software module, which uses the location of sale and the place of purchase to calculate the cost of transportation. This service is included as part of the transaction after completion of the trade.

To complete the commercial transaction, appropriate modules for the online payment include a secured service of a Third-party-payment-company, such as Pay-Pal, as part of the trading platform (cf. Fig. 6).

After completion of the transaction, a feedback step helps seller and buyer of the used car vehicle to evaluate each other (cf. Fig. 3). This covers the quality of data input by the seller of the vehicle as well as the smoothness of the payment and transportation by the buyer. This feedback loop is established in all known trading platforms and it is critical for the trust and sustainable success of a long-range web-based tool.

Process analysis and optimization

To evaluate the overall trade process, the application of cross-enterprise Value Stream Management is advantageous to visualize and optimize product and information flows. Thus, the application of Value Stream Management, a Lean Management tool that originates from manufacturing industry, is transferred to a predominantly data-driven process beyond corporate boundaries.

The current process comprises ten process steps, from which two are conducted externally. Based on this current state, a future state with potentials for further improvement of the entire process flow is designed (cf. Fig. 7).

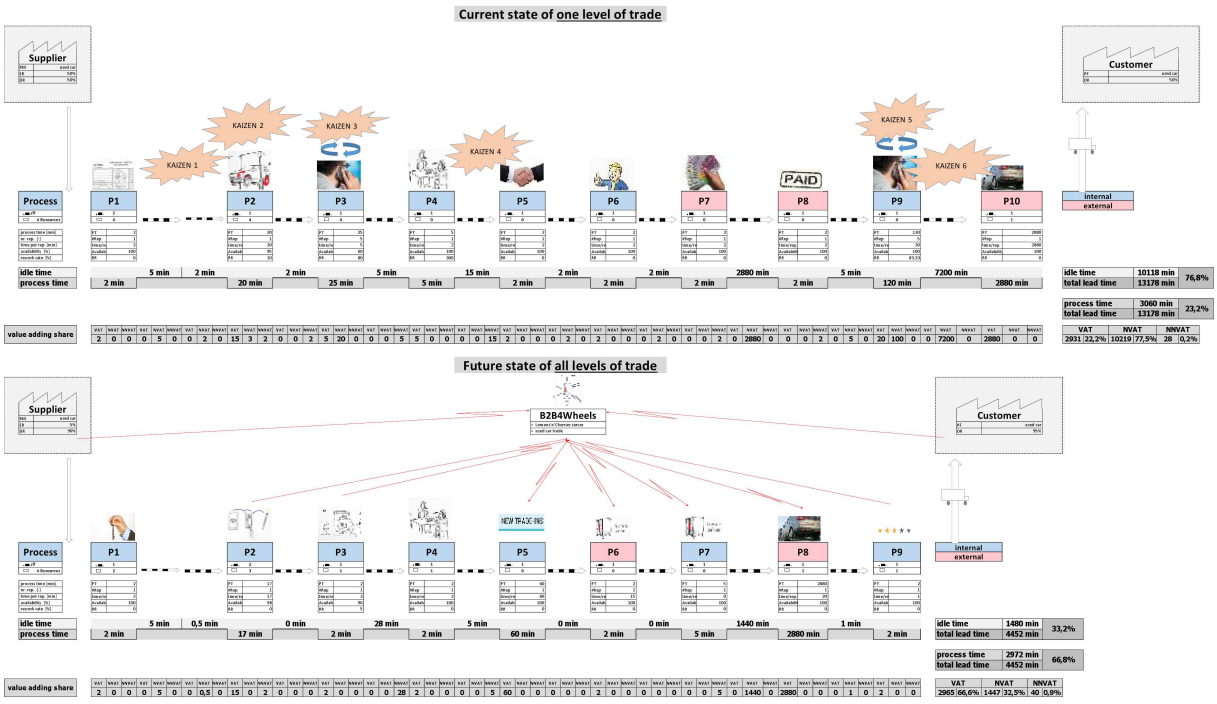

Fig. 6. Current and future state of the value stream.

A comparison of the current and the future state, both from customer and used car dealer perspective, reveals significant improvement potentials in regard to time, quality and costs. The estimated reduction of total lead time is expected in the range of 6 days, from 9 days in current state to 3 days in the planned future state. The quality of the transaction can be improved since the error rate can be decreased based on standardized, intuitive and user-friendly interfaces of the envisaged car evaluation and trading software. In line with the total lead time reduction, the overall process cost can be decreased by accelerating the car trading process through the elimination of intermediate trade levels.

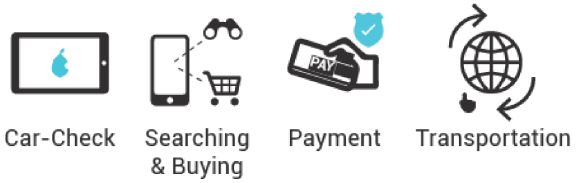

Fig. 7. Integrated services of web-based retail platform.

An analysis of the value-added share, which means a detailed assessment of value-adding time (VAT), non-value-adding time (NVAT) as well as necessary but non-value-adding time (NNVAT), shows a high proportion of NVAT of almost 80% in current state, which could be reduced in the designed future state to approximately 30%.

In addition to the conventional VSM diagram, a combination of the typical VSM diagram and Swimlanes is useful to highlight responsibilities and information flows within the trading process (cf. Fig. 8).

Due to the high connectivity of responsibilities in the future state in comparison with the current state, a smoothening of the overall process flow based on standardized order confirmation and related information exchange is achieved. The previously separated process of trading, payment and transportation is now automatically interlinked, which contributes to a more reliable, time-saving and cost-efficient process flow.

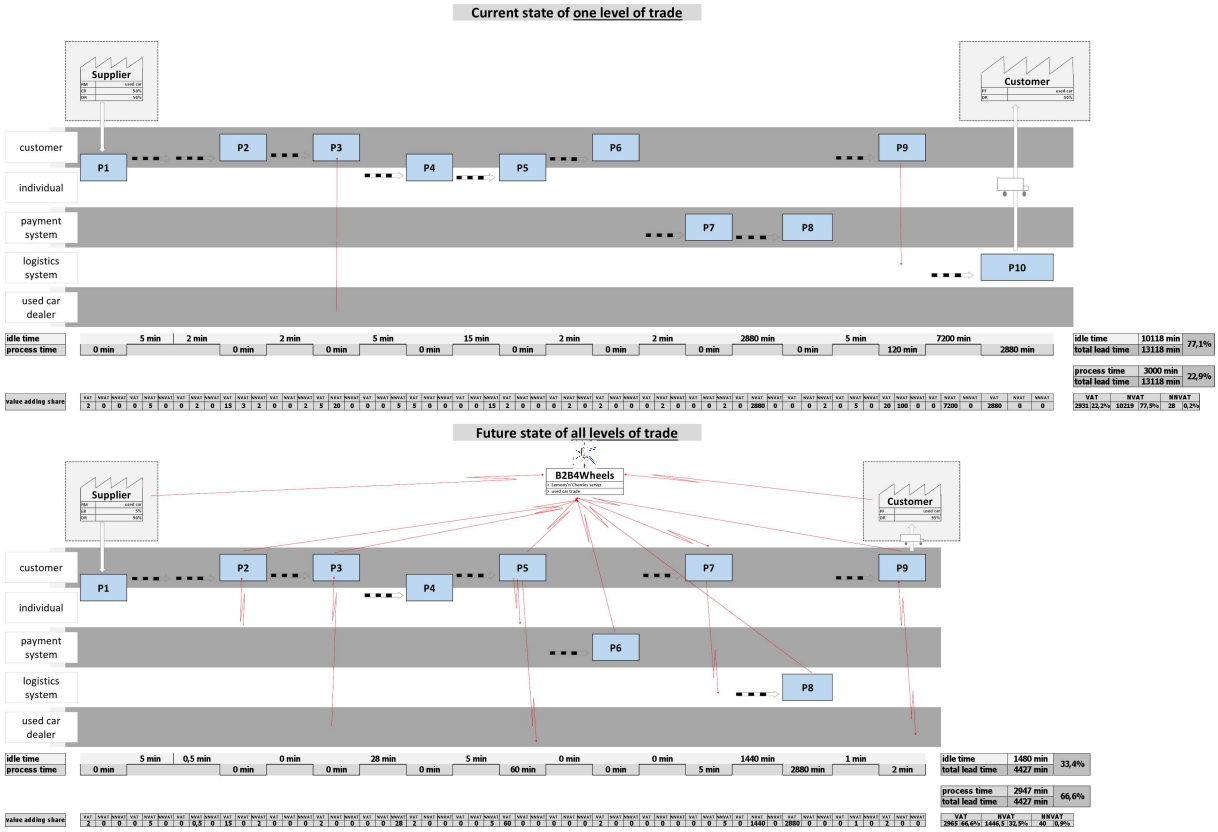

Fig. 8. Combination of VSM and Swimlane diagrams.

Summary

This paper describes the need of common processes for data collection and a standardized representation of product information in order to continuously improve the value stream in supply chain networks.

A commonized process, optimized and balanced for all partners, is required to eliminate waste at the interfaces to other companies in B2B interactions. EDI enables automated information exchange without human interaction, avoiding human error or misinterpretation and ensuring efficient transactions. Nevertheless, it is still a challenge for versatile, frequently changing customer interactions, like in automotive retail business.

Based on the scientific and managerial insights of this work, a versatile, and comprehensive web-based trading platform is presented, which eliminates waste in the used car B2B trading business. A graphical representation of the vehicle is used by the vehicle evaluation tool Cartron©. Step-by-step it guides the seller through the commonly used process and collects all price relevant data in a standardized format.

The web-based trading platform offers a seamless service for all steps of a convenient and efficient used vehicle retail business. It includes all steps, like offering, price finding and business transaction in a comprehensive online platform, which also provides functions like logistic services, financial transaction and a mandatory feedback loop.

By means of a visualization of the overall trading process, improvement potentials in regard to the application of cross-enterprise Value Stream Management are identified. A combination of a typical VSM diagram and Swimlanes are used to assess and structure responsibilities and related information flows.

The main limitations of the proposed solution are that it has only been validated so far in selected economic sectors and with a predefined scope.

Possibilities for future investigations with regard to the data-driven car trading process are related to a detailed analysis of further quality, cost or risk parameters. It is also envisaged to transfer the described solution to other purchase and buying processes, e.g. for the trading of "difficult-to-evaluate, remotely-located and complex used-products".

The authors would like to thank gratefully the industrial partner Uwe Reis, CEO of B2B4Wheels, for his valuable contribution to this publication. Part of this research was carried out in the course of research project "StreaM", which is funded by the Fonds National de la Recherche, Luxembourg (#7898133).

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